National Aeronautics and
Space Administration

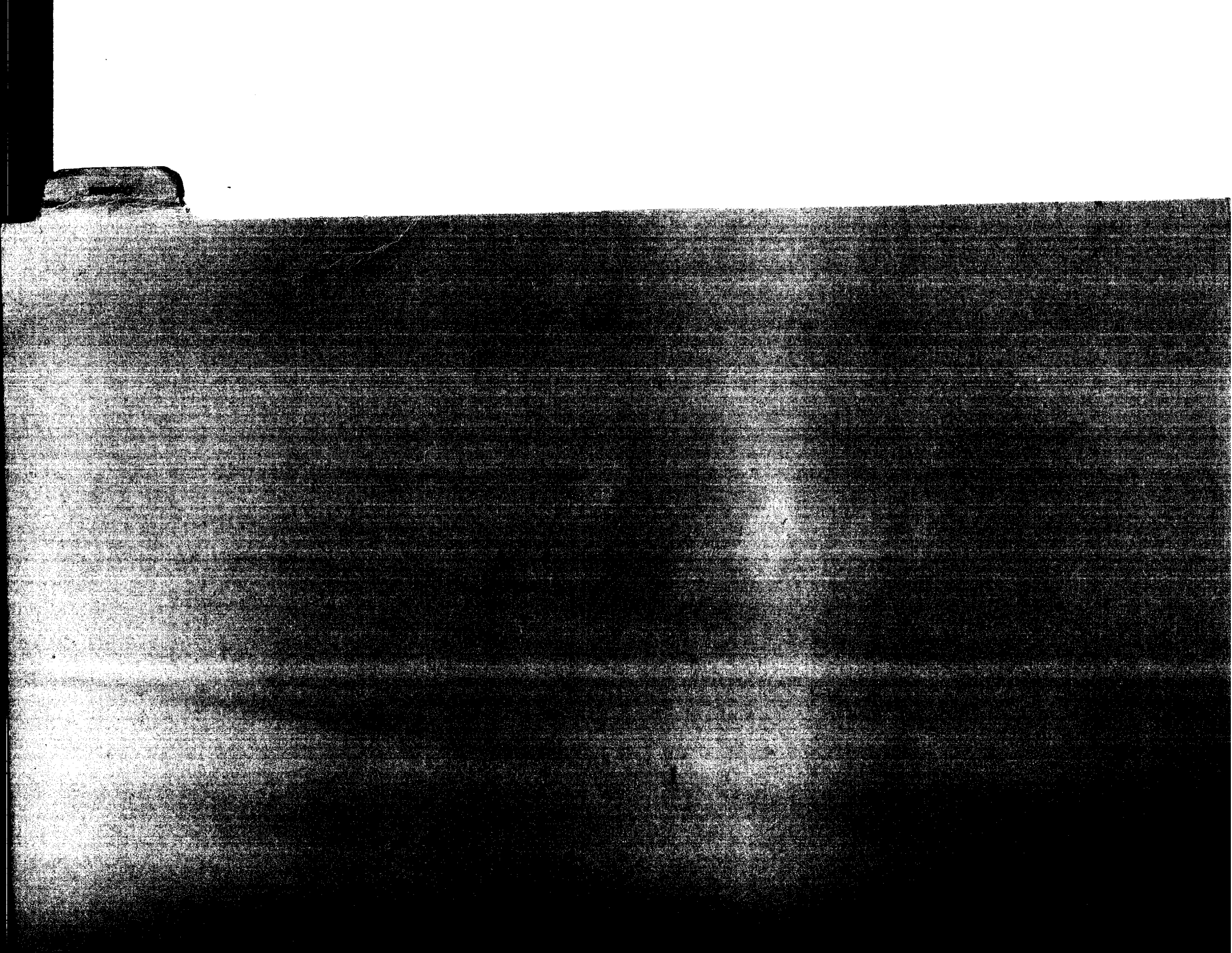
Budget Estimate

Fiscal Year 1996

Volume II

Mission Support

Inspector General



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VOLUME 11

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MISSION SUPPORT

FISCAL YEAR 1996 ESTIMATES

GENERAL STATEMENT

The Mission Support appropriation provides funding for NASA's civil service workforce, space communication services, safety and quality assurance activities, and for maintenance activities for the NASA institution. These objectives are accomplished through the following elements:

Safety, Reliability and Quality Assurance: This includes funding for programs to assure the safety and quality of NASA missions, through the development, implementation and oversight of Agencywide safety, reliability, maintainability and quality assurance policies and procedures.

Space Communication Services: This includes funding for the operation of the tracking, telemetry, command, data acquisition, and communications and data processing activities that are required by all NASA projects. This includes the Tracking and Data Relay Satellite System (TDRSS) and the telecommunications system which provides for real time transmission of data, video and voice information between and among NASA installations.

Research and Program Management: This includes funding for the salaries, benefits, travel requirements and other support of the civil service workforce, and the necessary funding for all of NASA's administrative functions in support of research in NASA's field centers.

Construction of Facilities: This includes funding for the modification, rehabilitation, repair and construction of the administrative facilities, the environmental compliance and restortation program, and the advanced planning of facilities and design of future facilities.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MISSION SUPPORT
FISCAL YEAR 1996 BUDGET ESTIMATES
(MILLIONS OF DOLLARS)

	BUDGET PLAN 1994	1995	1996
MISSION SUPPORT	2,667.4	2,589.2	2,726.2
SAFETY, RELIABILITY AND QUALITY ASSURANCE	34.3	38.7	37.6
SPACE COMMUNICATION SERVICES	248.2	226.5	319.4
RESEARCH AND PROGRAM MANAGEMENT	2,175.6	2,189.0	2,202.8
CONSTRUCTION OF FACILITIES	209.3	135.0	166.4

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION LANGUAGE

MISSION SUPPORT

For necessary **expenses,** not otherwise provided for, in carrying out mission support for **human** space flight programs and science, aeronautical, and technology programs, including research operations **and** support, ***space*** communications activities including operations, production, and **services;** maintenance; construction of facilities including repair, rehabilitation, and modification of facilities, minor **construction** of new facilities and additions to existing facilities, facility planning and design, environmental compliance and restoration, **and** acquisition or condemnation of real property, as authorized by law; program management; personnel **and** related **costs,** including uniforms or allowances therefor, as authorized by law **(5U.S.C.5901–5902);** travel expenses; purchase, lease, **charter,** maintenance, and operation of mission and administrative **aircraft;** not **to** ***exceed*** $35,000 for official reception and representation expenses; and ***purchase*** (not **to exceed** thirty-three for replacement only) and him of passenger motor vehicles; **[$2,554,587,000]** ***$2,726,200,000, to*** remain available until September **30, [**1996: ***Provided,*** That **of** the amounts made available under the heading 'Research and program management" in Public **Law 103–211, $18,000,000** are rescinded immediately upon enactment of **this** Act *Provided* ***further,*** That an additional **$18,000,000, to** remain available until September 30, **1995,** shall **be** immediately available for research and program management activities, contingent upon the enactment of the rescission in the preceding proviso before **October 1, 19941** ***1997. (Departments of Veterans Affairs and Housing*** **and** ***Urban Development,*** **and** ***Independent Agencies Appropriations Act, 1995.)***

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MISSION SUPPORT
REIMBURSABLE SUMMARY
IN MILLIONS OF REAL YEAR DOLLARS

(MILLIONS OF DOLLARS)

	BUDGET PLAN		
	1994	1995	1996
MISSION SUPPORT	59.1	85.6	84.7
SAFETY, RELIABILITY AND QUALITY ASSURANCE	0.6	1.1	1.1
SPACE COMMUNICATION SERVICES	35.2	61.4	62.4
RESEARCH AND PROGRAM MANAGEMENT	18.7	19.0	19.5
CONSTRUCTION OF FACILITIES	4.6	4.1	1.7

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1996 ESTIMATES

DISTRIBUTION OF MISSION SUPPORT BY INSTALLATION
(Thousands of Dollars)

Program		Total	Johnson Space Center	Space Station Program Office	Kennedy Space Center	Marshall Space Flight Center	Stennis Space Center	Ames Research Center	Dryden Flight Research Center	Langley Research Center	Lewis Research Center	Goddard Space Flight Center	Jet Propulsion Lab	Headquarters
Safety, Reliability and Quality Assurance	1994	34,300	3,957	0	1,472	1,841	663	725	8	2,261	4,504	4,641	3,348	10,880
	1995	38,700	4,794	0	1,449	1,795	415	550	125	1,480	3,845	5,685	4,929	13,633
	1996	37,600	4,700	0	1,400	1,750	400	535	100	1,425	3,790	5,300	4,850	13,350
Space Communication Services	1994	248,192	0	0	0	93,873	0	6,600	0	0	0	134,772	9,041	3,906
	1995	226,487	0	0	0	65,087	0	0	0	0	2,000	149,100	6,600	3,700
	1996	319,400	0	0	0	50,200	0	0	0	0	11,900	247,000	6,900	3,400
Research and Program Management	1994	2,175,634	338,644	16,180	249,571	300,480	31,509	164,187	35,996	214,444	219,407	314,904	0	290,312
	1995	2,189,000	336,596	30,251	250,499	292,144	32,015	169,026	38,830	220,353	215,321	329,468	0	274,497
	1996	2,202,800	341,222	30,466	250,620	296,333	32,179	170,287	39,028	221,886	217,739	333,664	0	269,376
Construction of Facilities	1994	179,954	12,033	0	27,763	36,390	8,505	13,402	3,760	12,551	16,370	32,543	10,820	5,817
	1995	116,045	10,150	0	11,150	23,675	4,280	9,800	11,210	9,020	9,650	14,430	10,910	1,770
	1996	145,820	13,355	0	14,900	28,640	8,800	18,130	3,320	8,295	19,265	16,675	13,300	1,140
Undistributed:														
Various locations	1994	7,846												
	1995	8,955												
	1996	10,580												
Facility Planning and Design	1994	21,500												
	1995	10,000												
	1996	10,000												
Total Construction of Facilities	1994	209,300												
	1995	135,000												
	1996	166,400												
TOTAL MISSION SUPPORT	1994	2,667,426	354,634	16,180	278,806	432,584	40,677	184,914	39,764	229,256	240,281	486,860	23,209	310,915
	1995	2,589,187	351,540	30,251	263,098	382,701	36,710	179,376	50,165	230,853	230,816	498,683	22,439	293,600
	1996	2,726,200	359,277	30,466	266,920	376,923	41,379	188,952	42,448	231,606	252,694	602,639	25,050	287,266

MISSION SUPPORT

FISCAL YEAR 1996 ESTIMATES

BUDGET SUMMARY

OFFICE OF *SAFETY AND* MISSION ASSURANCE
OFFICE OF THE CHIEF ENGINEER

SAFETY, RELIABILITY, MAINTAINABILITY AND QUALITY ASSURANCE

SUMMARY OF RESOURCES REQUIREMENTS

	FY 1994	FY 1995	FY 1996	Page Number
		(Thousands of Dollars)		
Policy, oversight, and standards	27.273	15.475	17.600	MS 1-2
Quality management	3.452	9.118	8.100	MS 1-2
Software independent verification and validation	3.575	8.186	6.400	MS 1-2
Engineering	--	5.921	5.500	MS 1-2
Total	34.300	38.700	37.600	
Distribution of Program Amount by Installation				
Johnson Space Center	3.957	4.794	4.700	
Kennedy Space Center	1.472	1.449	1.400	
Marshall Space Flight Center	1.841	1.795	1.750	
Stennis Space Center	663	415	400	
Ames Research Center	725	550	535	
Dryden Flight Research Center	8	125	100	
Langley Research Center	2.261	1.480	1.425	
Lewis Research Center	4.504	3.845	3.790	
Goddard Space Flight Center	4.641	5.685	5.300	
Jet Propulsion Laboratory	3.348	4.929	4.850	
Headquarters	10.880	13.633	13.350	
Total	34.300	38.700	37.600	

OFFICE OF SAFETY AND MISSION ASSURANCE
OFFICE OF THE CHIEF ENGINEER

SAFETY, RELIABILITY, MAINTAINABILITY AND QUALITY ASSURANCE

PROGRAM GOALS

To ensure the safe and successful execution of NASA programs by providing oversight of NASA's flight and ground systems development and operations programs: by developing agencywide safety, reliability, maintainability, quality assurance and engineering policies, standards and practices; and by providing for the identification and qualification of key technologies to improve the performance and reliability of NASA flight systems.

STRATEGY FOR ACHIEVING GOALS

NASA's Officeof Safety and Mission Assurance (OSMA) and Office of the Chief Engineer (OCE) provide leadership in promoting and ensuring the safety, innovation, and quality of all NASA programs; and improving the practice of engineering in NASA programs. This work is performed in four programmatic areas. These are the Policy, Oversight. and Standards: Quality Management: Software Independent Verification and Validation (IV&V); and Engineering programs. Targeted initiatives in each of these areas are intended to facilitate the ability of NASA's strategic enterprises to accomplish their goals in a safe and efficient manner.

Beginning in FY 1995, the engineering function and associated funding previously managed by NASA's OSMA are transferred to the OCE. No interruption in the conduct of these activities will occur.

The Policy, Oversight, and Standards program supports the areas of safety. reliability, maintainability and quality assurance (SRM&QA). Activities include studies and investigations to formulate NASA safety and mission assurance policy: and safety oversight and flight readiness assessments for NASA programs. Documentation and analysis of NASA experience in the SRM&QA disciplines, mishap investigations, NASA emergency preparedness, and range safety helps improve the safety and risk management practices of NASA programs. Guidance to the Agency's SRM&QA organizations for the conduct of self-assessments will be used to augment OSMA's oversight role and enhance the implementation of SRM&QA policies. Compliance with the Occupational Safety and Health Act is supported and monitored. NASA is also in the process of adopting the international standard for quality, ISO 9000, in concert with the Department of Defense (DoD) and other federal agencies.

The focus of the Quality Management program is to support the early introduction of tailored safety. reliability, and quality requirements into space flight systems design and manufacture in the early stages of a program. This approach is expected to result in decreased life cycle costs in NASA programs, by reducing or eliminating costly redesign of systems in the latter stages of development and test. The Quality Management program provides direct assurance support to NASA robotics, aeronautics, and expendable launch vehicle programs. Studies of optimized quality assurance surveillance for Space Transportation System (STS)

processing are also performed. Studies are conducted of risk factors in specific flight programs: the effectiveness of qualification test methods; and non-destructive evaluation techniques. Improved qualification methods for electrical. electronic, and electro-mechanical (EEE)parts and qualification of advanced EEE parts and packaging technologies for use by NASA flight programs are supported. New focus will be given to qualification of parts manufacturing processes rather than the previous focus on auditing parts quality.

NASA's Software IV&V program supports the management of NASA's IV&V facility located at Fairmont. West Virginia. This program supports the development of software assurance standards, practices, and technology for evaluation of flight system, mission control, and science data processing systems software. This initiative is expected to result in enhanced performance and reliability of increasingly complex and critical software used throughout NASA facilities and systems.

The Engineering program provides both oversight and improvement of NASA's technical ability to successfully execute its programs. The OCE provides direct support to the NASA Administrator by conducting independent evaluation of the performance of NASA programs and other engineering issues. The OCE also coordinates the activities of NASA's Engineering Management Council. The OCE develops NASA engineering policies, standards and guidelines: promotes increased use of industry and international standards to enhance the interoperability of NASA and other aerospace systems: encourages cooperative endeavors: and seeks to improve NASA-industry exchanges. Efforts to improve engineering practices in areas such as systems engineering, software engineering, structural analysis, and test methods will facilitate continuous improvement of NASA capabilities. Validation of critical technologies, focusing on demonstration of potential program applications to improve system reliability and performance, is also performed.

As a part of their responsibilities, the two NASA Headquarters offices also coordinate NASA activities with various external groups and agencies, such as by providing funds to the Air Force Composite Pressure Vessel Standards to develop a joint standard meeting NASA and DoD needs at greatly reduced cost to NASA. Innovative packaging techniques for electronic systems are jointly supported by industry, NASA, and the Advanced Research Projects Agency (ARPA). NASA also participates in the Government-Industry Data Exchange Program (GIDEP),a Governmentwide initiative. Japan's National Space Development Agency (NASDA) and NASA are co-funding studies and experiments on the explosive equivalence of large-quantity H_2/O_2 mixtures: and NASA, NASDA, and the European, Canadian, and Russian Space Agencies are to form an international SRM&QA working group focusing on safety, quality assurance, and electronic parts. NASA also participates in the Interagency Nuclear Safety Review Panel for issues related to NASA's use of nuclear systems, as in the case of the Cassini mission.

NASA supports a joint effort with the Departments of Commerce, Defense and Energy in development of an international Product Data Exchange Standard: with the Department of the Air Force for development and qualification of space batteries: and with the Federal Aviation Administration for U.S. adoption of NASA fracture analysis methods for aging aircraft. A cooperative program with the aerospace industry will demonstrate commercial implementation of laser-initiated ordnance systems. NASA also participates in the U.S. Secretariat of the International Standards Organization for adoption of standards for the design, safety, and interoperability of space flight systems.

NASA adoption of international standards for space systems development and quality promises to improve NASA's ability to coordinate its affairs with its international partners and to improve the competitiveness of U.S. industry in world markets.

MEASURES OF PERFORMANCE

Mishap Prevention	The mishap prevention program will continue to contribute to reducing time lost to accidents at NASA facilities.
Independent Assessments, Oversight, and Reviews	Independent assessments, oversight, and flight readiness reviews will contribute to the safety and success of NASA missions by ensuring that programs have resolved all technical issues. This includes review of the adequacy of program SRM&QA and engineering efforts and independently analyzing critical issues.
Engineering Standards and Practices	Establishment of baseline standards for NASA use will increase commonality and interoperability of aerospace systems; and enhance experience-based engineering practice.
Safety and Quality Specifications and Standards	NASA specifications and standards will be replaced, where possible, with industry, voluntary. and international standards. Adoption of ISO 9000 for quality programs is a major component of this effort. This will reduce the direct cost of requiring NASA unique standards in the procurement of flight and ground systems.
Technology Validation	Ground and flight demonstration of maturing technology in critical areas will improve the reliability of systems and facilitate advanced technology utilization throughout industry.
EEE parts and Packaging	Parts selection databases will enable projects to quickly select the most reliable parts available. Qualification of advanced parts and packaging technologies will reduce the size. weight, and power requirements of spacecraft systems.
Non-destructive evaluation (NDE) Technologies	Transferring improved NDE technologies from laboratory demonstrations to production use will reduce the need for costly and time-consuming tear downs, replacements, and destructive tests.

ACCOMPLISHMENTS AND PLANS

In FY **1994,** the SRM&QA program achieved a number of successes in assurance oversight and support; formulation of agencywide policies and standards; and validation and program integration of advanced technologies. Seven flights of the Space Transportation System (STS) were supported, including the complex First Servicing Mission for the Hubble Space Telescope. Independent review and certification effortsrelated to the Hubble mission were also conducted. Flight Readiness Reviews. risk assessments, and direct support to "better, faster, cheaper" space flight programs were conducted through a series of special reviews. Direct support to all NASA major program design reviews was also provided.

Independent reviews were conducted on Space Shuttle engine weld integrity and test requirements for the super-lightweighttank. Special technical readiness reviews were performed for the WIND and **NOAA-14** spacecraft launches. The loss of Mars Observer was documented for improvement of future spacecraft designs. Reliability Centered Maintenance and predictive maintenance techniques for use by STS facilities were adopted. **An** Independent Assessment function was established for the international Space Station; ***26*** formal assessments were completed. Work to initiate ajoint set of NASA/Russian safety standards and standard equivalence was begun. Streamlined reliability and assurance requirements for low-cost missions were developed by **OSMA,** enabling the Near Earth Asteroid Rendezvous (NEAR), Mars Global Surveyor (MGS). and Mars Pathfinder programs to better balance mission risks against cost constraints.

The **OSMA** also performed functional management reviews of all NASA Centers' SRM&QA programs in FY **1994.** Structured surveillance, problem reporting and corrective action programs were implemented at the Kennedy Space Center.

Policies and standards in the areas of explosives handling, fire hazards, factors of safely, vibro-acoustic testing. structural loads definition, and software life-cycle management were initiated in FY **1994** and will be completed in FY **1995.** Standardization of NASA use of materials was also initiated in FY **1994,** and NASA participation in international standardization of space systems was significantly increased. Guidelines for selecting breakdown resistant wiring systems and improved measurement and test calibration for space applications was also completed in FY **1994.** A set of Reliability Best Practices and Maintainability Preferred Practices was issued throughout the Agency. NASA also formally adopted ISO **9000,** the international quality standard, in FY **1994.**

The NDE techniques for optically-stimulated electron emission, STS window defect analysis, and silicon nitride ball bearings in oxygen environments were developed. Monolithic microwave integrated circuits, opto-electric circuits, multi-chip modules and other electronic packaging techniques were qualified for use. providing advanced technology for **NASA's** new better, faster, cheaper space flight systems. Radiation testing was completed on several classes of electronic parts. Work on advanced pyrotechnics and metric fasteners was also completed in FY **1994.** NASA's IV&V facility opened at Fairmont, West Virginia: a cooperative agreement with West Virginia University was concluded and research began on software assurance methodologies, including quantitative, fault analysis, and formal methods of analysis. ***As*** a part of its support to the nation's Federal Emergency Management program. the SRM&QA program provided funding for aerial reconnaissance in the aftermath of the Northridge, California earthquake.

In FY **1995,** oversight and support for the seven deployments of the STS, including the Space Shuttle/MIR rendezvous missions:

Critical Design Review (CDR) of the super-lightweight tank, alternate fuel turbopump, and lightweight solid rocket booster programs: and continued evaluation of test methods and assurance techniques for small spacecraft will be supported. Oversight and analysis will continue for the three Space Shuttle/Mir rendezvous missions. Independent assessment of the Tethered Satellite System (TSS) mission and technical reviews of the Advanced X-ray Astrophysical Facility (AXAF), Cassini, and POLAR missions *are* planned.

Independent assessment of the international Space Station will continue to evaluate the program using a prioritized task list while also responding to any newly-identifled concerns. A structured Mission Needs Analysis approach has been adopted for the review of hardware design approaches, safety hazards, and integration and test procedures. Six NASA Centers are scheduled for Functional Management Reviews in FY 1995.

NASA policies for mishap reporting, human factors for safety, robotic system and expendable launch vehicle safety, and risk management are to be reviewed. An initiative to effectively use previous test and operating experience to improve the design, test, and mission assurance processes over the life-cycle of spacecraft programs is also being supported. *An* agencywide career development and training program to increase the NASA personnel SRM&QA skills will be initiated.

The NDE techniques for optically-stimulated electron emission and STS window defect analysis will be qualified for production use. A long-term effort to reduce spacecraft size and weight through electronic miniaturization will be initiated. New approaches to product assurance for micro-spacecraft, such as the planned New Millennium program. will be developed. Flight demonstration of a fiber-optic gyroscope and a laser-initiated ordnance system will complete efforts to enhance the performance, reliability. and safety of these critical flight systems. Flight measurements aboard the STS will demonstrate the ability of a force-limited vibration test technique to simulate payload flight environments with reduced risk of hardware damage. Also in FY 1995. a testbed will be used to simulate on-orbit power system operations as a part of NASA's spacecraft battery investigations. A joint NASA-Air Force initiative is to characterize and validate advanced nickel-cadmium and nickel-hydrogen battery systems for future missions. In FY 1996, a flight set of advanced nickel-hydrogen batteries will be qualified through stress testing.

Finally, FY 1995 will see the completed evaluation of current NASA software assurance techniques. This will serve as a baseline for assessment of future improvements. Advanced IV&V methods will be examined on a selective basis. A stream-lined, cost-effective approach to software IV&V for complex programs is to be developed in FY 1995.

NASA's FY 1996 program will continue to assure adequate oversight of NASA programs: targeted development of key engineering and SRM&QA directives, standards and processes: and to support the transition of certain critical technologies from testbed to program use. Independent assessment of NASA's STS and international Space Station programs will continue, ensuring that performance goals and schedule milestones are met with acceptable levels of safety. Fire detection and power system stability and plasma studies will be given special emphasis. "Better. cheaper. faster" mission assurance practices will be evaluated and modified as necessary in FY 1996, including continued support for the Small Satellite Technology Initiative. All NASA space flight programs will be reviewed against these newly adopted mission success criteria.

The OCE will issue systems engineering guidelines for NASA program management in FY 1996. establishing a uniform basis for program technical reviews and to improve NASA's program management process. The budget supports continuation of the program for more effective and benign test methods for qualification and acceptance testing of space systems, including two approaches for avoiding overtest damage to spacecraft. Fracture control methods will be adapted for ground system life prediction and for aging aircraft assessment. Standards will be developed for space equipment racks in order to reduce the cost and simplify of payload servicing operations; and for application of telecommunications standards to NASA data handling functions. The first international space system standards are expected to be published in FY 1996 for standardization of launch vehicle-spacecraft interfaces, pressure vessel design and analysis, and electronic parts control. Development of metric specifications for space components will continue. Documentation of Ada flight software management procedures for NASA flight programs will be completed.

The budget supports continued evaluations of reliability-centered maintenance, hypervelocity impacts, embedded software systems, debris hazards, and wind tunnel safety. Studies of rescue breathing devices, composite pressure vessel reliability, predictive time lining, preferred maintenance practices, risk analysis methods, orbiter outgassing, and assurance practices for aeronautics facilities will continue. Work on measurement assurance and calibration standards for temperature, mass, acceleration, flight voltage resistance, and quantum-Hall resistance will be completed in FY 1996. An evaluation of NASA's implementation of the international quality standard, ISO 9000, will also be performed to determine whether this approach improves quality and reduces program costs. The requested funding also supports improvement of databases and selection tools for electronic and mechanical parts, enabling NASA programs to select the most reliable parts available. Qualification of advanced electronics parts and packaging technologies and study of NDE techniques for Space Shuttle structures, anomalous ultrasonic signal interpretation, and snake ultrasonic leak detection will be conducted.

Emphasis will continue to be placed on the development and demonstration of improved pyrotechnic systems and components and of laser-initiated termination systems. Simulation of aerospace battery operations for the Compton Gamma Ray Observatory (CGRO). the Upper Atmospheric Research Satellite (UARS), and Ocean Topography Experiment (TOPEX) missions will continue. Development of test methods for advanced nickel-cadmium and nickel-hydrogen cells and improvements in the battery design process are anticipated.

In FY 1996, research and demonstration of software assurance techniques for selected programs will be performed. These early initiatives will explore software criticality assessment, requirement traceability, and verification process methods. Management of NASA's IV&V facility. which hosts several tenant NASA programs, will continue.

Space Communication
Services

MISSION SUPPORT

FISCAL YEAR 1996 ESTIMATES

BUDGET SUMMARY

OFFICE OF SPACE COMMUNICATIONS — SPACE COMMUNICATION SERVICES

SUMMARY OF RESOURCES REQUIREMENTS

	FY 1994	FY 1995 (Thousands of Dollars)	FY 1996	Page Number
Space network	117,674	111,587	206,700	MS 2-4
Telecommunications	130.518	114.900	112.700	MS 2-10
To	248.192	226.487	319.400	
Distribution of Program Amount by Installation				
Marshall Space Flight Center	93.873	65.087	50.200	
Ames Research Center	6.600	--	--	
Lewis Research Center	--	2,000	11,900	
Goddard Space Flight Center	134.772	149.100	247,000	
Jet Propulsion Laboratory	9.041	6.600	6.900	
Headquarters.	3.906	3.700	3.400	
To	848.192	226.487	319.400	

OFFICE OF SPACE COMMUNICATIONS **SPACE COMMUNICATION SERVICES**

PROGRAM GOAL

To enable the conduct of the NASA strategic enterprises by providing telecommunications systems and senrices. Reliable electronic communications are essential to the success of every NASA flight mission, from interplanetary spacecraft to the Space Shuttle to aeronautical flight tests.

NASA's Office of Space Communications (OSC) manages the provision of telecommunication senrices needed to ensure that the goals of NASA's exploration, science, and research and development programs are met: that they are met cost-effectively: and that mission operations and planning are performed in an integrated and standardized way. The OSC is committed to seeking and encouraging commercialization of NASA telecommunications capabilities and to participate with NASA's strategic enterprises in collaborative interagency, international. and commercial enterprises. As NASA's agent for operational communications and associated information handling services, the OSC seeks opportunities for using technology in pursuit of more cost-effective solutions, highly optimized designs of mission systems, and advancement of NASA's and the nation's best technological and commercial interests.

STRATEGY FOR ACHIEVING GOALS

The range of capabilities provided by NASA's Space Communications program is necessarily very broad. This function provides all of NASA's capability to track, command, and acquire data from NASA spacecraft. This function is performed through utilization of ground-based antennas and network systems: the Tracking and Data Relay Satellite System (TDRSS) of geosynchronous communications satellites and its Earth-bound ground stations: a telecommunications network needed to relay data among NASA mission control facilities: and the mission control and data processing facilities for NASA's currently operational Earth-orbiting robotics systems. The function also provides for the telecommunications network used for all NASA administrative and scientific exchanges. All NASA telecommunications scheduling, network management and engineering, flight system maneuver planning and analysis, and preflight communications interface verification is performed by this strategic function. Near-term demonstration and application of advanced communications and information systems technologies are conducted through the support of various sponsored labs and facilities.

Some NASA missions have unique needs -- e.g., communicating with spacecraft having low-powered transceivers flying in the outer reaches of our solar system and beyond or relaying very high rates of data from spacecraft anywhere over the roughly 785 million square miles of surface area of the Earth. Specialized systems such as the Tracking and Data Relay Satellite System (TDRSS) and the Deep Space Network (DSN) are required. Other needs can be satisfied using alternate approaches, including

smaller ground transceiver systems and commercially-available systems and services. Key to NASA's future is our ability to take advantage of emerging communications technologies, especially the increasing levels of automation and standardization of systems and procedures that these technologies allow.

Integrated solutions to Agency communication and information management needs are sought based on understanding and accommodating common aspects of all of NASA's programs. Cost-effective systems are achieved through an integrated, end-to-end approach to the design of communication systems, including the large and costly data processing systems needed to support current and future NASA missions. NASA flight programs are supported through study and coordination of the data standards and communications frequencies to be used in the future.

The Space Communications function is carried out collaboratively with other NASA programs in the formulation of NASA's policy interests. When science or exploration goals require coordination of international or other U.S. telecommunications, mission control or data processing capabilities, NASA's space communication assets are incorporated into agreements and understandings. International and interagency agreements are entered into for the exchange of communication services among space-faring nations. other U.S. agencies, and in support of commercial U.S. space enterprises.

As part of the second phase of the National Performance Review, NASA has been tasked to explore how more of NASA's Tracking and Data Relay Satellite (TDRS) requirements could be met with broader-based commercial communication services.

The Space Communication Services program, one part of NASA's Space Communications program, provides high data rate. near-continuous coverage of Earth-orbiting spacecraft, including the Space Transportation System (STS); and NASA-wide telecommunications network services. The unique requirements of some suborbital missions for continuous tracking and communication services are also supported by this program. Services include tracking, spacecraft command, spacecraft health and safety data acquisition. and science data acquisition: and telecommunications services for all of NASA's operational. research and analysis. and administrative requirements. —

The seventh Tracking and Data Relay Satellite (TDRS) is scheduled to be deployed in FY 1995: the new Danzante, or Second TDRS System Ground Terminal (STGT), was recently designated the primary ground terminal for the TDRSS: and development of 3 TDRS Replenishment Spacecraft is about to begin. Upgrade of the Cacique, previously known as the White Sands Ground Terminal (WSGT), will soon be underway, scheduled for completion in FY 1996. Operational support for NASA's STS and other high data rate scientific spacecraft missions will continue, including the nation's premiere astronomical observatory, the Hubble Space Telescope (HST).

An upcoming demonstration of advanced switching technology promises to allow the consolidation and improved efficiency of service of NASA telecommunications networks.

BASIS OF FY 1996 FUNDING REQUIREMENT

SPACE NETWORK

	FY 1994	FY 1995	FY 1996
		(Thousands of Dollars)	
Space network services	55,701	13,200	10,700
*TDRS replacement spacecraft	5.700	22,200	--
TDRS replacement launch senrlces.	34,673	15.587	--
*TDRS replenishment program	2.600	42,000	195.800
*Second TDRSS ground terminal	19.000	18.600	200
To	117.674	111.587	206.700

• Total Cost information is provided in the Special Issues section.

PROGRAM GOALS

To provide reliable, cost-effective space-based tracking, command and data acquisition systems and services for NASA's Human Space Flight program, other low-Earth orbiting science missions, including observatory-class systems. and selected sub-orbital flight systems. The Space Network program provides for the implementation, maintenance and operation of the tracking and communication systems and facilities necessary to ensure the health and safety and the sustained level of high quality performance of NASA flight systems. Launch systems needed to deploy the Tracking and Data Relay Satellites (TDRS) spacecraft are also included under this program.

The Space Network program supports NASA's programs in collaborative interagency, international, and commercial enterprises; and independently provides support to other national and commercial space-faring enterprises on a reimbursable basis.

STRATEGY FOR ACHIEVING GOALS

NASA's Space Network is comprised of a constellation of geostationary TDRS and associated dual ground terminals located in White Sands, New Mexico. The current TDRS constellation consists of three fully functional satellites. and two partially functional satellites. The last satellite, launched in January 1993, was recently used to verify the performance of the Second TDRS System (TDRSS) Ground Terminal (STGT) prior to its acceptance for operation. This spacecraft has been returned to backup on-orbit availability. One partially functional satellite is being operated to reduce schedule overloads during Shuttle missions: the other has been repositioned over the Indian Ocean to increase data return from the Compton Gamma Ray Observatory (CGRO). The CGRO experienced problems with its tape recorder subsystem, requiring a remote ground terminal and dedicated data relay satellite to complete its scientific mission.

The Goddard Space Flight Center (GSFC) manages the Space Network program, including the procurement of replenishment satellites and development, upgrade and maintenance of the ground facilities necessary to sustain network operations for current and future missions. TRW is the prime contractor for the TDRS Replacement Spacecraft program. The prime contractor for the TDRS Replenishment Spacecraft program has not been selected. The development of Danzante. the designated title of the STGT, and the modification and modernization of the original ground station, Cacique, is the responsibility of Martin Marietta Corporation. The GTE Corporation and the AlliedSignal Technical Services Corporation are the contractors responsible for operating the TDRS spacecraft from the White Sands location. Beginning in FY 1996, these two contracts will be merged. Engineering and software support are provided by the Computer Sciences Corporation.

In coordination with NASA's Ground Network program which provides launch and landing support for the Space Transportation System (STS) and the Space Network Customer Services program which provides scheduling. engineering and preflight communication subsystems verification for spacecraft to be supported by the Space Network NASA's Space Network program provides unique high data rate, near-continuous communication services to any user outfitted for access to the TDRSS. These include NASA's STS, other compatible low-Earth orbiting missions, and selected suborbital systems. The TDRSS serves as the primary data relay service for NASA's Human Space Flight program. Telemetry relay services are provided at data rates up to 300 Mbps using its Ku-band single-access antenna service, data rates up to 3 Mbps using S-band single-access service, and a low rate service up to 50 Kbps using the TDRS spacecraft's multiple-access service. Service ranges from low rate commanding of robotic space flight systems to wide-band televideo services provided for NASA's Human Space Flight endeavors. Acquisition of the high rate science data characteristic of NASA's Earth Observing System (EOS) is also within the capacity of NASA's Space Network system. A new initiative to develop a low-power. low-weight transponder system for spacecraft applications. co-funded under the Mission Control and Data Systems long-range technology program and the Space Network Customer Services program, promises to expand the scope and number of users of the TDRSS.

Besides operation of the current constellation of data relay satellites and ground terminals which compose the TDRSS. NASA's Space Network program also provides for continuous replenishment of the spacecraft assets of the system. The TDRS Replacement Spacecraft program, begun in FY 1987 as a result of the loss of a TDRS spacecraft aboard Challenger, is now in the latter stages of development and will result in the addition of a sixth functionally-identical, nearly design-identical spacecraft to the current constellation of TDRS. Due to spacecraft reliability assessments which indicate that a sufficient number of TDRS may not be available by the end of the decade, the TDRS Replenishment Spacecraft program is also being initiated. Contract proposals for an additional 3 TDRS spacecraft have been under review by NASA since the latter part of 1994. Contract award and the initiation of development of these spacecraft is scheduled to occur in February 1995. Due to the high degree of sensitivity regarding this firm fixed price, commercial practices procurement, further details regarding the proposed design, capability, cost, launch requirements. and other details of the program are unavailable at this time. NASA is considering identifying additional FY 1995 funds to apply to the TDRS Replenishment program.

Development of Danzante has been completed. Begun in FY 1989 and recently delayed due to technical difficulties in completing some of the more advanced features of the new ground terminal and in ensuring complete user satisfaction with the service, Danzante was approved for primary operations in December 1994. Cacique, formerly known as the White Sands Ground Terminal (WSGT), is currently operating in a backup mode to Danzante and will begin its own refurbishment once Danzante has fully

demonstrated stable support to all of its users. As was originally proposed at the time of initiation of the STGT program, the new ground terminal will preclude the possibility of loss of the Space Network system, with attendant interruption of the operation of the space flight systems which the telecommunication system supports, which would have occurred had the single ground terminal been lost to a natural disaster, fire or other catastrophic incident. The new ground terminal and its refurbished twin is also expected to reduce the cost of operating and sustaining both terminals of the White Sands Complex below the level formerly required to support one ground terminal. Finally, the reliability, quality, and volume of TDRSS service available to users will increase as a result of this program.

Besides the development of capital facilities, the Space Network requires a variety of collateral activities. The Space Network Services program provides for the White Sands Complex activities needed to operate and maintain NASA's Space Network Operation at this site includes monitoring of ground terminal performance; commanding and monitoring of the TDRS spacecraft themselves: and interface with the Network Control Center (NCC), located at the GSFC, from which user spacecraft services are scheduled. Operation and support for the NCC is provided for under the Space Network Customer Services program under the NASA Appropriation for Science, Aeronautics and Technology. Because a large portion of TDRSS services are consumed by other U.S. agencies on a reimbursable basis. a large budgetary offset is assigned to the Space Network Services program. This program element is co-funded by these reimbursable receipts and by direct appropriation authority.

The Space Network Services program also provides for data buffering for STS telemetry. telecommunications line outage recording, data link monitoring, and security for secure communication services for user systems. Voice and televideo services are provided for STS operations. The Compton Gamma Ray Observatory Remote Terminal System (GRTS) located at Tidbinbilla, Australia, used to operate a TDRS spacecraft located over the Indian Ocean for CGRO science data acquisition. is remotely controlled from the White Sands Complex.

The Space Network will supply telecommunication for the International Space Station (ISS), including the needs of the international partners. Agreements are in place with Japan, the European Space Agency (ESA), and Canada. Negotiations are continuing with the Russian Space Agency (RSA) as a participant for potential cooperative endeavors in telecommunications.

MEASURES OF PERFORMANCE

	FY 1994	FY 1995	FY 1996
Number of hours of space network service..	6.100	26,500	26,900

TDRS Replacement Spacecraft

Complete Thermal-Vacuum Tests May 1994	Testing verified the systems ability to perform in temperature extremes in the environment of space.
Complete Single Access Antenna Installation December 1994	This final step in assembly of major appendages allows final integration and testing to begin prior to shipment of the spacecraft to Kennedy Space Center.
Satellite Deployment by the STS June 1995	Deployment, followed by a checkout period, places all existing NASA TDRS assets in their on-orbit operational and backup positions.

Second TDRSS Ground Terminal

Provisional Contract Acceptance April 1994	Acceptance allowed for continued testing and final problem resolution by AlliedSignal Technical Services Corporation. the operations contractor for STGT, to begin. The development contract warranty and sustaining engineering support periods also began.
Initial Operational Capability (IOC) September 1994	Declaration of IOC allowed the STGT to begin operational support for STS and user spacecraft systems on a test and event-shadowing basis. Initiation of a 6 month period of stable operational support required prior to WSGT Decommission also began.
One Time Switch over December 1994	STGT was declared the primary operational facility of TDRSS, allowing the level of operational support provided by that facility to grow to normal operational workloads.
STGT Full Operational Capability (FOC) February 1995	This event, following 6 months of stable use and support of user spacecraft operations, allows the WSGT to be shut down for its refurbishment.
Complete WSGT Level 6 Testing March 1996	Completion of end-to-end systems-level testing allows the WSGT to be returned to service and the original goal of the STGT development program, to ensure fail-safe TDRSS operations, to be met.

TDRS Replenishment Spacecraft

Contract Award February 1995	Early design activities will begin.
Preliminary Design Review August 1995 (Preliminary)	Verification that the proposed contractor design will meet NASA performance requirements will be performed.
Critical Design Review March 1996 (Preliminary)	Verification that the spacecraft development contractor is prepared to begin development and manufacture of the TDRS spacecraft will be performed, including detailed manufacturing assembly and integration and test processes.
Complete TDRS-H Integration and Test December 1998 (Preliminary)	Completion of spacecraft aliveness, performance, and environmental tests allows final assembly and retesting to begin prior to shipment for launch.
Launch TDRS-H 1 Qtr. 1999	Launch within four years of contract award will be performed, ensuring the continuity of TDRSS services to user space flight systems. Launch of TDRS-I and TDRS-J is scheduled one and two years following the launch of the first TDRS Replenishment Spacecraft.

ACCOMPLISHMENTS AND PLANS

In FY 1994, the TDRSS Space Network provided support for the HST First Servicing Mission and 6 other missions of the STS, including the Space Radar Lab (SRL-1), Spacehab-2, International Microgravity Lab (IML-2), and Space Life Sciences (SLS-2). Operational support was also provided to the CGRO, the Upper Atmosphere Research Satellite (UARS), the Earth Radiation Budget Satellite (ERBS), the Extreme Ultraviolet Explorer (EUVE), and the Ocean Topography Experiment (TOPEX). Support is also provided for classified users of NASA's Space Network system.

In FY 1995, the X-ray Timing Explorer (XTE), the Long Duration Balloon Program, and NASA's ER-2 Earth science research aircraft will be added to the workload of the TDRSS Space Network. Seven flights of the STS are planned, including Spacehab-3. U.S. Microgravity Lab (USML-2), Atmospheric Laboratory for Applications and Science (ATLAS-3) SRL-2, Astro-2, the first Shuttle/MIR rendezvous. and the deployment of the seventh TDRS. No new robotic spacecraft missions are to be added to the Space Network workload in FY 1996. Seven flights of STS are scheduled, including Tether Satellite System (TSS), Spacehab-4, Life and Microgravity Spacelab. and three additional Shuttle/MIR rendezvous missions.

In FY 1994, the TDRS Replacement Spacecraft completed thermal-vacuum testing and began final assembly of all appendages: multiple access antennas were installed in FY 1994 and single access antennas were installed early in FY 1995. The program is on schedule for a planned deployment in June 1995.

Technical difficulties were resolved in the development of the new Danzante. or STGT. ground terminal in FY 1994. Following provisional contract acceptance in April 1994, Initial Operational Capability was declared in September 1994. and Danzante is currently performing as the primary ground terminal for the Space Network. Once Full Operational Capability is certified, the Cacique ground terminal will discontinue backup operations and begin to be refurbished. This event, scheduled for March 1995, is to be followed by a year-long equipment installation and facilities refurbishment effort leading to a return of Cacique service in April 1996. One of the two operational ground terminals will be held in a standby condition in support of TDRSS operations, subject to user need for the services of additional TDRS spacecraft which would require the concurrent operation of more than 3 TDRS spacecraft.

FY 1994 saw continued preparation and initiation of procurement activities for the TDRS Replenishment Spacecraft program. Offeror's proposals are currently under review, with contract award scheduled for February 1995. Due to the high degree of sensitivity regarding this firm fixed price, commercial practices procurement, further details regarding the proposed design, capability, cost. launch requirements, and other details of the program are unavailable at this time. Preliminary Government schedules indicate that a Preliminary Design type review will be performed near the end of FY 1995, and a Critical Design type review around mid-FY 1996. Scheduled events and the type of oversight procedures to be adopted in this procurement are subject to contract negotiation.

24 hour per day, 7 day per week operations and maintenance support of the White Sands Complex was sustained throughout FY 1994 and will continue through FY 1996. Support provided for operation of Cacique by GTE Corporation under the TDRSS program has been merged beginning in FY 1995 with the Space Network Services program. The latter program will henceforth provide the funds necessary for operation and maintenance of both ground terminals at the White Sands Complex. Staff of GTE are to support tear-down and refurbishment of the Cacique terminal beginning in March 1995. and will be merged with staff of the AlliedSignal Technical Services Corporation under a single contract beginning in FY 1996. Operations planning for current and future missions to be supported by NASA's Space Network are supported through the Space Network Services program. This includes planning for deployment of the seventh TDRS spacecraft in June 1995: for flights of the STS, its attached payloads, and Shuttle/MIR rendezvous events: and for the future International Space Station. Tropical Rainfall Measurement Mission (TRMM), and the Earth Observing System (EOS) AM-1 mission. Future command-only support for the Gravity Probe-B (GP-B) mission is also being planned. The TDRSS Space Network will be the primary telecommunication system for the International Space Station.

BASIS OF FY 1996 FUNDING REQUIREMENT

IUNIC

	FY 1994	FY 1995	FY 1996
		(Thousands of Dollars)	
Telecommunications	130.518	114,900	112,700

PROGRAM GOALS

To provide reliable. cost-effective telecommunications systems and services for mission control, science data handling, and program administration for NASA programs. The Telecommunications program provides for the implementation. maintenance and operation of the telecommunication circuits. control centers, switching systems, and other equipment necessary to provide an integrated approach to NASA communication requirements.

The Telecommunications program supports NASA's programs in collaborative interagency. international, and commercial enterprises; many collaborative arrangements are performed on a reimbursable basis.

STRATEGY FOR ACHIEVING GOALS

NASA's Telecommunications program is a nationwide system of leased voice, video. data. and wide-band terrestrial and satellite circuits: control centers, switching centers, network equipment, and other communications devices. International telecommunications links are also provided to NASA's Deep Space Network (DSN) sites in Australia and Spain: Spaceflight Tracking and Data Network (STDN) sites outside the Continental U.S. : and to common telecommunications exchange points that provide interconnectivity to NASA international partners. Administrative. scientific, and mission control exchanges among NASA and its industrial and scientific partners are supported by NASA's telecommunications networks and systems. Support and participation by other U.S. agencies, universities. and research centers: and by other space-faxing nations are also facilitated, including the provision of secure circuits, systems, and facilities. Domestic telecommunications circuits are leased by NASA under the FTS-2000 contract managed by the General Services Administration (GSA); international circuits are leased under separate contractual arrangements. NASA's telecommunications program maintains cooperative networking agreements for exchanging services with the European Space Agency (ESA), Canada, Japan, France, and Russia. The Computer Sciences Corporation and AlliedSignal Technical Services Corporation provide engineering and operations support for the telecommunications networks.

Currently, NASA telecommunications services are provided by two separate networks: these are the NASA Communications Network (NASCOM), managed by the Goddard Space Flight Center (GSFC). and the Program Support Communications Network (PSCN), managed by the Marshall Space Flight Center (MSFC). A major NASCOM sub-switching center for overseas communications services is located at the Jet Propulsion Laboratory (JPL). Each network provides a unique set of services to all NASA Centers and to other users.

NASCOM interconnects all NASA installations, including spacecraft mission control facilities, tracking and data acquisition networks, launch sites, NASA data processing centers, and scientific investigators whose support is critical to mission control and command. Command, telemetry and voice systems are provided for NASA mission control activities. NASA aeronautical test sites and preflight verification of NASA spacecraft systems and their interconnectivity with NASA communications systems are also supported by NASCOM.

- The PSCN interconnects NASA installations and national and international aerospace contractors, laboratories. scientific investigators, educational institutions. and other Government installations in support of the administration, science data exchange, and other research and analysis type activities. The PSCN provides voice and video teleconferencing, broadcast television. computer networking services as well as data handling and transfer services.

NASA's Telecommunications program provides for the improvement, operation and maintenance of NASA network systems and facilities. Telecommunications network systems include digital voice: data and video switching equipment: audio and video conferencing and bridging systems: wide band multiplexing equipment: and sophisticated network management. monitoring and fault isolation systems. Equipment and facilities of NASA Select Television is also provided by the Telecommunications program.

NASA is in the process of demonstrating the use of Asynchronous Transfer Mode (ATM) telecommunications switching technology for management of wide band networks: this advanced technology allows for sharing of leased circuits among NASA users. If successful, this demonstration promises to enhance the integration of NASA telecommunications requirements, providing for additional economies-of-scale, enhanced reliability through circuit diversity at reduced cost, optimization of NASA utilization of leased circuit bandwidths, and more rapid universal application of common data standards for NASA systems. At that time, the consolidation of the transmission infrastructure of the NASA telecommunications networks will be examined.

MEASURES OF PERFORMANCE

	FY 1994	FY 1995	FY 1996
Number of end user spacecraft contacts using NASCOM	79.400	87,300	96.000
Number of locations connected by PSCN	481	500	520
Number of electronic conferences supported by PSCN	2,030	2,230	2,450

ACCOMPLISHMENTS AND PLANS

In FY 1994. telecommunications services and systems were provided to support all NASA operational flight systems. Services were also provided for all administrative, programmatic and technical information exchanges required for pre-flight systems: and NASA

transmission of data to NASA-supported scientists and researchers. NASCOM circuits were added for support of the Atmospheric Laboratory for Applications and Science (ATLAS-3) and International Microgravity Lab (IML-2) missions, and in support of the X-ray Timing Explorer (XTE) and international RadarSat program. During FY 1994, the PSCN was extended to provide services in Russia to meet the networking requirements of the international Space Station and other collaborative flight and scientific missions. A network switching center has been established in Moscow to provide voice, data and video services to several locations. PSCN services were also extended to NASA's Independent Verification and Validation (IV&V) facility located at Fairmont. West Virginia.

Also in FY 1994. initiatives to provide a new NASCOM Digital Matrix Switch and automation of command and status systems was initiated. These projects are scheduled for completion in FY 1995. In FY 1996. NASCOM statistical multiplexers at four NASA Centers: this work is to be completed in FY 1997. Finally, the NASCOM program is in the process of providing new cable facilities for the operational local area network at the GSFC.

The PSCN will add circuit concentrators. network routers, and voice and video equipment for new communication gateways in Moscow and Fairmont, West Virginia in FY 1994. In FY 1995 and 1996, equipment for all network gateways will be added in support of low bandwidth video conferencing and to upgrade the network management system.

During FY 1995. the initial phase of providing NASCOM service to Moscow will be completed in time to support the first Shuttle/MIR mission. Other circuits will be added for the Eureca-3 and Tropical Rainfall Measurement Mission (TRMM). New mission requirements will be accommodated within existing PSCN capacity in FY 1995 and 1996, and existing NASCOM capacity in FY 1996.

Finally, the ATM pilot will begin in FY 1995 requiring limited procurement of hardware for demonstration of the new switching technology at four NASA sites. Network operations using representative telecommunications traffic loads will begin late in the fiscal year and continue until all technical and operational issues have been addressed.


Research and Program
Management

RESEARCH AND PROGRAM MANAGEMENT

PROGRAM GOALS

To acquire and maintain a civil service workforce which reflects the cultural diversity of the Nation and is sized and skilled consistent with accomplishing NASAs research, development, and operational missions with innovation, excellence, and efficiency.

STRATEGY FOR ACHIEVING GOALS

The Research and Program Management (R&PM) program provides the salaries, other personnel and related costs, travel and the necessary support for all of NASA's administrative functions and other basic services in support of research and development activities at NASA Installations. This civil service workforce is the underpinning for the successful accomplishment of the Nation's civil aeronautics and space programs. These are the people who plan the programs; conduct and oversee the research: select and monitor the contractors; manage the various research, development, and test activities; and oversee all of NASAs operations. The salaries and benefits of this workforce comprise approximately 76% of the requested funding. Administrative and other support is 22% of the request. The remaining 2% of the request is required to fund travel necessary to manage NASA and its programs and provide the training and other supporting costs for NASA personnel.

ACCOMPLISHMENTS AND PLANS

The Deficit Reduction Executive Order of 1993 required Federal agencies to reduce their workforce by 4% by the end of FY 1995. Additionally, 10% of the reduction was to be taken in the GS-14 and above pay grades. The FY 1994 VA-HUD Independent Agencies Appropriation Act (P.L. 103-124) required that the Agency's employment at the end of FY 1994 be 22,900 full-time equivalencies (FTE's), with at least a 30% reduction in the Space Station program. NASA exceeded all goals established by the President and the Congress with a total personnel complement of 22,892.

Through the implementation of hiring constraints and the overwhelmingly successful implementation of the Voluntary Separation Incentive Program (buyout), NASA reached the goals established for FY 1995 by the end of 1994. We have reduced employment by approximately 8%. Of that reduction, at least 10% were in pay grades GS-14 and above. In concert with the redesign and restructuring of the Space Station we have reduced the FTE level for this program by approximately 45% from the FY 1994 appropriation request.

The focus of FY 1995 and FY 1996 activities are to assure the effective and efficient distribution/redistribution of a diverse and sufficiently trained post buyout workforce to meet the highly specialized demands of NASAs research, development, and operational programs and activities in concert with National Performance Review (NPR) streamlining guidance and direction.

During 1995, each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

The FY 1996 budget estimate of $2,202.8 million represents an increase of $13.8 million over the FY 1995 budget plan of $2,189.0 million. Of the increase: $10.3 million is for the full year costs of the FY 1995 pay raises and $27.9 million represents the costs of pay raises anticipated for January 1996. The increases above are offset by savings of $2.6 million associated with the reduction of 47 FTE, $3.2 million due to reducing requirements for travel and $18.6 million due to further belt tightening in the Research Operations Support account. The FY 1995 budget reflects the rescission of one million dollars for two of eight NASA administrative aircraft. An ongoing study of the use and need of the remaining aircraft will be conducted prior to phasing out additional planes. This increase over FY 1995 is less than both inflation and the cost of required pay increases. This request does not include costs associated with pay increases greater than 2.6% in January 1995 and 2.2% for January 1996.

In summary. the FY 1996 budget requirement of $2,202,800,000 is to provide for 23,028 FTE civil service workyears in order to support the activities at nine NASA Installations and Headquarters.

The following describes, in detail, the cost elements within this program.

I. Personnel and Related Costs

A. Compensation and Benefits:

1. Compensation:

a. Permanent Positions: This part of Personnel and Related Costs covers the salaries of the full-time permanent civil service workforce and is the largest portion of this functional category.

b. Other Than Full-Time Permanent Positions: This category includes the salaries of NASAs non-permanent workforce. Programs such as Presidential Management Interns. students participating in cooperative training, summer employment, youth opportunity, and temporary clerical support are covered in this category.

c. Reimbursable Detailees: In accordance with existing agreements, NASA reimburses the parent Federal organization for the salaries and related costs of persons detailed to NASA.

d. Overtime and Other Compensation: Overtime, holiday, post and night differential. and hazardous duty pay are included in this category. Also included are incentive awards for outstanding achievement and superior performance.

2. Benefits: In addition to compensation, NASA, as authorized and required by law, makes the employer's contribution to personnel benefits. These benefits include contributions to the Civil Service Retirement Fund, the Federal Employees Retirement System, employees' life and health insurance, payments to the Medicare fund for permanent employees, and social security contributions. Payments to the civil service retirement fund for re-employed annuitants and severance pay to former employees involuntarily separated through no fault of their own are also included.

B. Supporting Costs:

1. Transfer of Personnel: Provided under this category are relocation costs required by law, such as the expenses of selling and buying a home, subsistence expenses, and the movement and storage of household goods.

2. Investigative Services: The Office of Personnel Management is reimbursed for activities such as security investigations of new hires and revalidation of sensitive position clearances, recruitment advertising, and Federal wage system surveys.

3. Personnel Training: Training is provided within the framework of the Government Employees Training Act of 1958. Part of the training costs are for courses offered by other Government agencies, and the remainder is for training through nongovernment sources.

11. Travel

A. Program Travel: The largest part of travel is for direction, coordination, and management of program activities including international programs and activities. The complexity of the programs and the geographical distribution of NASA Installations and contractors necessitate this category of travel. As projects reach the flight stage, support is required for prelaunch activities including overseas travel to launch and tracking sites. The amount of travel required for flight projects is significant as it is directly related to the number of systems and subsystems, the number of design reviews, and the number and complexity of the launches and associated ground operations.

B. Scientific and Technical Development Travel: Travel to scientific and technical meetings and seminars permits employees engaged in research and development to participate in both Government sponsored and nongovernment sponsored activities. This participation allows personnel to benefit from exposure to technological advances which arise outside NASA, as well as allowing personnel to present both accomplishments and problems to their associates and provides for the dissemination of technical results to the United States community.

C. Management and Operations Travel: Management and operations travel provides for the direction and coordination of general management matters and travel by officials to review the status of programs. It also includes travel by functional managers in such areas as personnel, financial management, and procurement. This category also includes the cost of travel of unpaid members of research advisory committees: and initial duty station, permanent change of assignment, and related travel expenses.

III. Research Operations Support

A. Facilities Services: Facilities Services provides basic security, fire protection, and other custodial services. It also provides maintenance of roads and grounds and of all administrative buildings and facilities. Finally, it provides rental of administrative buildings and all utility costs of administrative buildings.

B. Technical Services: Technical Services provides the Administrative Automatic Data Processing capability that supports Accounting, Payroll, Budgeting, Procurement, and Personnel as well as all the other Administrative functions. It also funds the Graphics and Photographic support to these functions. Finally, it funds the Installationwide safety and public information programs.

C. Management and Operations: Management and Operations funds the telephone, mail, and logistics systems, the administrative equipment and supplies, and the transportation system including the general purpose motor pools and the program support aircraft. It also funds the basic medical and environmental health programs. Finally, it funds printing and reproduction and all other support, such as small contract and purchases for the Center Directors staff and the Administrative functions.

SUMMARY OF BUDGET PLAN BY FUNCTION

	FY 1994	FY 1995 (Thousand of Dollars)	FY 1996
I. Personnel and related costs	1,634,005	1,654,500	1,690,100
II. Travel	38,903	48,700	45,500
III. Research operations support	502.726	486,800	467.200
Subtotal	2,175,634	2,190,000	2,202,800
Proposed rescissions - research operations support	0.0	-1.000	0.0
Total	2,175,634	2,189,000	2,202,800

DETAIL OF BUDGET PLAN BY FUNCTION

		FY 1994	FY 1995	FY 1996
I.	**Personnel and related costs**	**1,634,005**	**1,654,500**	**1,690,100**
	A. Compensation and benefits	**1,583,957**	1,604,366	**1,654,343**
	1. Compensation	**1,313,676**	1,340,712	**1,378,288**
	2. Benefits	**270,281**	**263,654**	**276,055**
	B. Supporting costs	**50.048**	**50,134**	**35.757**
	1. Transfer of personnel	**10,157**	**13.134**	**6,262**
	2. Investigative services	**2.260**	**1,876**	**1,947**
	3. Personnel training	37,631	**35.124**	**27,548**
II.	**Travel**	**38,903**	**48,700**	**45,500**
	A. Program travel	**26.421**	**34,170**	**32,050**
	B. Scientific and technical development travel	**3,675**	**4,086**	**3,763**
	C. Management and operations travel	**8,807**	**10,444**	**9,687**
III.	**Research operations support**	**502.726**	**485,800**	**467,200**
	A. Facilities services	**163,961**	**160,634**	**151,381**
	B. Technical services	**172,249**	**161,325**	**155,799**
	C. Management and operations	**166,516**	**163,841**	**160,020**
Total		**2,175,634**	**2,189,000**	**2,202,800**

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

RESEARCH AND PROGRAM MANAGEMENT - FY 1996 ESTIMATES

FUNCTION	TOTAL NASA	JSC	SSPO	KSC	MSFC	SSC	ARC	DFRC	LARC	LERC	GSFC	HQ
Personnel and related costs												
FY 1994	1,634,005	255,257	14,532	164,254	240,268	14,010	131,412	29,215	180,228	178,521	260,135	166,173
FY 1995	1,654,500	251,218	26,557	166,337	233,207	15,682	136,464	33,023	188,138	176,571	271,559	155,744
FY 1996	1,690,100	259,756	27,014	169,512	239,452	15,782	139,688	33,373	191,666	181,083	281.348	151.426
Travel												
FY 1994	38,903	4,987	1,648	2,617	4,712	399	3,677	655	3,698	3,202	6.469	6,839
FY 1995	48,700	6,278	3,694	3,862	5,437	533	3,998	586	3,770	3,880	7,509	9.153
FY 1996	45,500	5,866	3,452	3,608	5,081	497	3,735	547	3.522	3,626	7,016	8.550
Research operations support												
FY 1994	502,726	78,400	0	82,700	55,500	17,100	29,098	6,126	30,518	37,684	48,300	117,300
FY 1995	485,800	79,100	0	80,300	53,500	15,800	28,564	5,221	28,445	34,870	50,400	109,600
FY 1996	467,200	75,600	0	77,500	51,800	15,900	26,864	5,108	26,698	33,030	45,300	109,400
Total												
FY 1994	2,175,634	338,644	16,180	249,571	300,480	31,509	164,187	35,996	214,444	219,407	314,904	290,312
FY 1995	2,189,000	336,596	30,251	250,499	292,144	32,015	169,026	38,830	220,353	215,321	329,468	274,497
FY 1996	2,202,800	341,222	30,466	250,620	296,333	32,179	170,287	39,028	221,886	217,739	333,664	269,376

SUMMARY OF BUDGET PLAN BY INSTALLATION

	FY 1994	FY 1995	FY 1996
Johnson Space Center (JSC)	338,644	336,596	341,222
Space Station Program Office (SSPO)	16.180	30,251	30,466
Kennedy Space Center (KSC)	249.571	250,499	250,620
Marshall Space Flight Center (MSFC)	300,480	292,144	296.333
Stennis Space Center (SSC)	31,509	32,015	32,179
Ames Research Center (ARC)	164,187	169,026	170.287
Dryden Flight Research Center (DFRC)	35,996	38,830	39,028
Langley Research Center (LaRC)	214.444	220,353	221,886
Lewis Research Center (LeRC)	219,407	215,321	217,739
Goddard Space Flight Center (GSFC)	314,904	329,468	333,664
Headquarters (HQ)	290.312	274.497	269,376
Total	2,175,634	2,189,000	2,202,800

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY INSTALLATION

	FY 1994	FY 1995	FY 1996
Johnson Space Center	3,404	3,214	3.209
Space Station Program Office	165	310	310
Kennedy Space Center	2,445	2,367	2.367
Marshall Space Flight Center	3,490	3,300	3.300
Stennis Space Center	199	208	208
Ames Research Center	1,708	1,678	1,677
Dryden Flight Research Center	431	460	460
Langley Research Center	2,820	2,788	2,784
Lewis Research Center	2,615	2,487	2,487
Goddard Space Flight Center	3,839	3,810	3,806
Headquarters	1.776	1,711	1.664
Subtotal, full-time permanent FTEs	22,892	22,333	22,272
Other controlled FTEs	777	742	756
Total, full-time equivalents	23.669	23.075	23,028*

* During 1995, each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

DISTRIBUTION OF FULLTIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM

	FY 1994	FY 1995	FY 1996
Space station	1,283	1,279	1,285
U.S./Russian cooperative program	15	38	39
Space shuttle/payload and utlization operations	5,282	5.077	5,015
Space science	2,112	2,006	1,948
Physics and astronomy	1,830	1,725	1,676
Planetary exploration	282	281	272
Life and microgravity sciences and applications	1,512	1,467	1,499
Mission to planet earth	1,553	1,549	1,595
Aeronautical research and technology	3,559	3,598	3,633
Space access and technology	1,684	1,681	1.615
Academic programs	76	77	77
Safety, reliability and quality assurance	130	140	138
Mission/space communication services	676	636	644
Subtotal, direct full-time permanent FTEs	17,882	17,548	17,488
Center management and operations	5,010	4.785	4,784
Subtotal, full-time permanent FTEs	22,892	22,333	22,272
Other controlled FTEs	777	742	756
Total, full-time equivalents	23,669	23.075	23,028*

* During 1995. each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1996 ESTIMATES

LYNDON B. JOHNSON SPACE CENTER

ROLES AND MISSIONS

SPACE STATION - Institutional personnel provide engineering and testbed support to the program. This includes test capabilities, the provision of Government Furnished Equipment (GFE), and engineering analysis support for the work of the prime contractor, its major subcontractors, and NASA system engineering and integration efforts. The Johnson Space Center (JSC) is the host center for the Space Station Program Office. A detailed narrative describing these activities is included separately.

The JSC shares the responsibility for operations capability and construction with Kennedy Space Center (KSC) and will develop a set of facilities and systems to conduct the operations of the Space Station. The JSC will develop systems for on-orbit operations control of the Space Station.

SPACE SHUTTLE/PAYLOAD AND UTILIZATION OPERATIONS - Provide support to Spacelab, the engineering technical base, payload operations and support equipment, and advanced programs. Conduct concept studies and development on flight systems and options for human transportation. Provide for Space Shuttle activities to support a schedule consistent with major program milestones. Provide development, integration, and operations support for the Mission Control Center (MCC), the Shuttle Mission Simulator (SMS), and other ground facilities needed for Space Shuttle operations. Provide for Space Shuttle operational flight program management including system integration, crew equipment modification and processing, crew training. flight mission planning and operations, and procurement of Orbiter hardware.

SPACE SCIENCE - Support the Agency's planetary science program in the area of geosciences required to support future programs, provide curatorial support for lunar materials, assist in information dissemination, and interact with outside scientists. The research focuses on the composition, structures, and evolutionary histories of the solid bodies of the universe.

LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS - Evaluate human physiological changes associated with the space flight environment and develop effective countermeasures to assure crew health and optimal performance during all phases of flight. Define and develop on-board health care systems and environmental monitoring systems: crew medical training; ground-based medical support of missions: develop a longitudinal crew health data base; and develop medical and psychological crew selection criteria. The JSC has established a center for the support of biotechnology applications in microgravity in order to study growth factors, medical chemo/immunotherapeutic, and human tissue transplantation. Integrates life science flight experiments for Spacelab: operates integrated payload systems; and trains mission and payload specialists in the science aspect of their missions. Provides mission integration and operations functions for experiments flown on the NASA-MIR program, including Space Shuttle flights as well as those transported via Russian launch vehicles applications.

SPACE ACCESS AND TECHNOLOGY - Provide technology to support the evolution of current launch vehicles, and the development of next generation transportation systems. Promote and develop private sector investment in space-based technologies and promote industrial productivity through the transfer to the nation's commercial sector of technologies that derive from NASA's programs and activities. Works to establish innovative partnerships and innovative approaches leading to new commercial enterprises, products, and services.

- **CENTER MANAGEMENT AND OPERATIONS** - Provide administrative and financial services in support of Center management and the Space Station Program Office, and provide for the operation and maintenance of the institutional facilities, systems, and equipment.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
JOHNSON SPACE CENTER

	FY 1994	FY 1995	FY 1996
Spacestation	538	372	372
U.S./Russian cooperative program	10	27	28
Space shuttle/payload and utilization operations	1,913	1,915	1,906
Space science	30	34	38
Physics and astronomy	0	0	0
Planetary exploration	30	34	38
Life and microgravity sciences and applications	160	167	167
Mission to planet earth	0	0	0
Aeronautical research and technology	0	0	0
Space access and technology	158	126	126
Academic programs	7	6	6
Safety, reliability and quality assurance	3	4	4
Mission/space communication services	0	0	0
Subtotal, direct full-time permanent FTEs	2,819	2,651	2,647
Center management and operations	585	563	562
Subtotal, full-time permanent FTEs	3,404	3,214	3,209
Other controlled FTEs	127	75	80
Total, full-time equivalents	3.531	3.289	3,289*

* During 1995, each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1996 ESTIMATES

SPACE STATION PROGRAM OFFICE

ROLES AND MISSIONS

SPACE STATION - The new international Space Station design requires the modification/deletion of hardware and includes the incorporation of significant Russian participation. Contract negotiations are underway with the Space Station prime contractor, Boeing, and its subcontractors to implement management and design changes. Negotiations with the international partners and Russia are being held to modify existing agreements where necessary.

Space Station elements will be provided by the U.S. and our international partners. The U.S. elements include two nodes, a laboratory module, truss segments, four photovoltaic arrays, a habitation module, three pressurized mating adapters, a cupola, and an unpresssurized logistics carrier. Various systems are also being developed by the U.S., including thermal control, life support, navigation and propulsion, command and data handling, power systems, and internal audio/video. U.S. elements also include the FGB Energy Tug, being provided by a Russian firm under the Boeing prime contract, and a pressurized logistics module, similarly provided by Italy.

Canada, European nations, Japan, and Russia are also developing hardware for the international Space Station. Laboratory elements will be provided by the Japanese and European Space Agencies. Canada will provide the remote manipulator system, vital for assembly of the station. The Russian Space Agency, invited to join the partnership, is providing experiment, power and service modules; a Soyuz crew transfer vehicle, and three docking modules.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
SPACE STATION PROGRAM OFFICE

	FY 1994	FY 1995	FY 1996
Space station	165	304	304
U.S./Russian cooperative program	0	6	6
Space shuttle/payload and utilization operations	0	0	0
Space science	0	0	0
Physics and astronomy	0	0	0
Planetary exploration	0	0	0
Life and microgravity sciences and applications	0	0	0
Mission to planet earth	0	0	0
Aeronautical research and technology	0	0	0
Space access and technology	0	0	0
Academic programs	0	0	0
Safety, reliability and quality assurance	0	0	0
Mission/space communication services	0	0	0
Subtotal, direct full-time permanent FTEs	**165**	**310**	**310**
Center management and operations	0	0	0
Subtotal, full-time permanent FTEs	**165**	**310**	**310**
Other controlled FTEs	3	3	3
Total, full-time equivalents	**168**	**313**	**313***

* During 1995, each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1996 ESTIMATES

JOHN F. KENNEDY SPACE CENTER

ROLES AND MISSIONS

SPACE STATION - The Kennedy Space Center (KSC) shares responsibility for operations capability and construction with the Johnson Space Center (JSC) to develop a set of facilities, systems, and capabilities to conduct the operations of the Space Station. The KSC will develop launch site operations capabilities for conducting prelaunch and post-landing ground operations including integrated testing, interface verification, servicing, launch activities, and experiment-to-rack physical integration.

SPACE SHUTTLE/PAYLOAD *AND* UTILIZATION OPERATIONS - Provide Space Shuttle launch preparation, including Spacelab assembly and checkout and payload experiment integration; upper stages processing: orbiter, Spacelab, and Ground Support Equipment (GSE) logistics: and operation and maintenance of GSE.

SPACE ACCESS AND TECHNOLOGY - Provide government oversight of all launch vehicle and payload processing and checkout activities for all **NASA** contracted expendable launch vehicle and upper stage launch services both at the KSC and the Vandenberg Air Force Base.

CENTER MANAGEMENT *AND* OPERATIONS - Provide administrative and financial services in support of Center management and provides for the operation and maintenance of the institutional facilities, systems, and equipment.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
KENNEDY SPACE CENTER

	FY 1994	FY 1995	FY 1996
Space station	169	191	191
U.S./Russian cooperative program	0	0	0
Space shuttle/payload and utilization operations	1,591	1,568	1,568
Space science	0	0	0
Physics and astronomy	0	0	0
Planetary exploration	0	0	0
Life and microgravity sciences and applications	119	112	112
Mission to planet earth	0	0	0
Aeronautical research and technology	0	0	0
Space access and technology	64	66	66
Academic programs	1	1	1
Safety, reliability and quality assurance	2	15	15
Mission/space communication services	0	0	0
Subtotal, direct full-time permanent FTEs	1,946	1,953	1,953
Center management and operations	499	414	414
Subtotal, full-time permanent FTEs	2,445	2,367	2,367
Other controlled FTEs	87	82	82
Total, full-time equivalents	2,532	2,449	2,449*

* During 1995, each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised elements for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1996 ESTIMATES

GEORGE C. MARSHALL SPACE FLIGHT CENTER

ROLES AND MISSIONS

SPACE STATION - Provide engineering and testbed support to the program including engineering analysis in support **of** the station system engineering and integration effort and the work **of** the prime and major subcontractors. Responsible for developing payload utilization capabilities and managing operations payload.

SPACE SHUTTLE/PAYLOAD *AND* UTILIZATION OPERATIONS - Design, development, and procurement **of** propulsion elements of the Space Transportation System. Study and defmition of future space programs including space transportation systems, space power and energy systems, space structures, space processing, and space science and applications facilities.

Spacecraft mission management including design, development and testing of payload carriers: payload definition; integration of science payloads into payload carriers; and operation of the payload integrated carrier systems.

SPACE SCIENCE -Development of the Advanced X-Ray Astrophysics Facility (AXAF) and the Relativity Mission (Gravity Probe-B), as well as management of the Astro and Tethered Satellite shuttle payloads.

LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS - Provide the fundamental science and technology for processing materials under conditions that allow detailed examination of the constraints imposed by gravitational forces. Perform research in the areas of crystal growth, fluid physics, biophysics, solidification mechanics, chemistry and polymeric materials. Integrates life and microgravity flight experiments and science and applications flight experiments for Spacelab; operates integrated payload systems: and trains mission and payload specialists in the science aspects of their missions.

SPACE ACCESS *AND* TECHNOLOGY - Provide propulsion and vehicle technology to reduce schedule and cost risk in the development of next generation expendable and reusable space transportation vehicles. Develops technology in hybrid and liquid propulsion systems, advanced manufacturing processes, and vehicle materials and structures. Conduct, technology efforts under cooperative agreements with the U.S. launch vehicle industry to improve the competitiveness of current systems.

MISSION TO PLANET EARTH - Conduct theoretical, field, and laboratory experimental research in the global weather, severe storms, and local weather areas in order to improve the understanding **of** severe storms, local and global scale weather systems.

MISSION/SPACE COMMUNICATION SERVICES - Manage and maintain the Program Support Communications Network (PSCN) which provides communications hardware, software, and transmission medium that inter-connects NASA Headquarters, Installations, and major contractor locations for the transfer of data, voice, and video.

CENTER MANAGEMENT AND OPERATIONS - Provide administrative and financial services in support of Center management and provides for the operation and maintenance of the institutional facilities, systems, and equipment. Lead center for the development and implementation of the NASA Financial Information System (NAFIS).

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
MARSHALL SPACE FLIGHT CENTER

	FY 1994	FY 1995	FY 1996
Space station	195	278	**286**
U.S./Russian cooperative program	0	0	**0**
Space shuttle/payload utilization operations	1,519	1,326	1,274
Space science	448	404	421
Physics and astronomy	441	404	421
Planetary exploration	7	0	**0**
Life and microgravity sciences and applications	552	528	555
Mission to planet earth	148	136	133
Aeronautical research and technology	2	0	**0**
Space access and technology	112	127	130
Academic programs	9	11	11
Safety, reliability and quality assurance	1	1	1
Mission/space communication services	16	18	**18**
Subtotal, direct full-time permanent FTEs	**3,002**	**2,829**	**2,829**
Center management and operations	488	471	471
Subtotal, full-time permanent FTEs	**3,490**	**3,300**	**3,300**
Other controlled FTEs	86	67	67
Total, full-time equivalents	**3.576**	**3.367**	**3,367***

* During 1995, each **NASA** Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1996 ESTIMATES

JOHN C. STENNIS SPACE CENTER

ROLES AND MISSIONS

SPACE SHUTTLE/PAYLOAD AND UTILIZATION OPERATIONS - Provide, operate, maintain, and manage a propulsion test center and related capabilities for development, certification, and acceptance of rocket propulsion systems and components. Provides, maintains, and manages the facilities and the related capabilities required for the continued development and acceptance testing of the Space Shuttle Main Engines.

MISSION TO PLANET EARTH - Conduct technology utilization, applications, and commercialization programs to support the Agency goals in environmental systems sciences and observations, remote sensing, and image processing systems and applicable products.

SPACE ACCESS *AND* TECHNOLOGY - Conduct fundamental and applied research, develops advanced airborne sensors and data/information systems, and conducts test and evaluation activities of remote sensing technology. *Also* conducts research into applications for non-remote sensing, primarily in such areas as environmental system development and closed ecosystems development.

Commercial program activities emphasize promoting and developing private sector investment in space-based technologies and promoting industrial productivity through the transfer of technologies that derive from NASA's research and development programs and activities.

AERONAUTICAL RESEARCH AND TECHNOLOGY - Conduct research and development programs that will advance propulsion test technologies for Government and commercial propulsion programs. Design, construction, and activation of the High Heat Flux Facility (HHFF) for high temperature material testing is underway. Conduct technology development projects, including Hydrogen Leak Detection and Plume Diagnostics.

CENTER MANAGEMENT AND OPERATIONS - Provide operate, maintain, and manage the institutional base and laboratories required to accomplish and support assigned programs of NASA and other Federal and State organizations resident at the Stennis Space Center.

DISTRIBUTION OF FULL-TIME EQUIVALEN (FTE) WORKYEARS BY PR
STENI IS E CENTER

	FY 1994	FY 1995	FY 1996
Space Station	0	0	0
U.S./Russian cooperative program	0	0	0
Space shuttle/payload and utilization operations	76	92	91
Space science	0	0	0
Physics and astronomy	0	0	0
Planetary exploration	0	0	0
Life and microgravity sciences and applications	0	0	0
Mission to planet earth	1	1	1
Aeronautical research and technology	20	9	9
Space access and technology	14	19	19
Academic programs	2	2	2
Safety, reliability and quality assurance	1	1	1
Mission/space communication services	0	0	0
Subtotal, direct fill-time permanent FTEs	**114**	**124**	**123**
Center management and operations	85	84	85
Subtotal, full-time permanent FTEs	**199**	**208**	**208**
Other controlled FTEs	15	18	18
Total, full-time equivalents	**214**	**226**	**226***

* During 1995, each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1996 ESTIMATES

AMES RESEARCH CENTER

ROLES AND MISSIONS

SPACE SCIENCE

Physics and Astronomy - Provide support for the airborne astronomy program with aircraft operated as flying astronomical observatories for research conducted by various NASA/university teams. The Ames Research Center (ARC) manages and operates a variety of these operational aircraft which serve as facilities for research. Provides infrared technology research program utilizing the unique capabilities of infrared astronomy to investigate the nature and evolution of astronomical systems.

Planetary Exploration - Provide a program of laboratory, computational, and theoretical studies to develop basic atmospheric planetary modeling concepts and obtain the necessary physical data to interpret spacecraft observations of planetary atmospheres and relate these data to the atmosphere of the Earth. Advanced studies of instrumentation and systems are carried out for potential deployment on future planetary missions.

LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS - Continue research on the effects of gravity on living systems using spaceflight experiments, ground simulation, and hypergravity facilities to understand the effects of gravity on the development of living systems, and to develop options for preventing health and psychophysiological problems during and following extended spaceflight. Develop the physical/chemical and regenerative life support technologies and extravehicular activity systems essential to exploration and extended presence in space. Continue biospherics research to enhance the understanding of the biological aspects of global conditions and biochemical processes on Earth.

MISSION TO PLANET EARTH - Develop instruments and computer models for the measurement and analysis of atmospheric constituents and properties from aircraft platforms. Perform applied research and development to enhance the use of remote and in-situ sensing technology for Earth resources applications.

SPACE ACCESS *AND* TECHNOLOGY - Conduct research on aerothermodynamics, thermal protection, infrared systems, spaceborne processors, sensor technology, robotics and artificial intelligence, technologies for humans in space, and advanced space platforms.

AERONAUTICAL RESEARCH AND TECHNOLOGY - Conduct fundamental aeronautics research including flight computational analysis, wind tunnel research, flight simulation, and flight research. This research forms a coherent and interdependent program to provide a technology base for the development of subsonic and high speed transport aircraft, hypersonic aircraft, advanced

rotorcraft and powered lift configurations, and the improvement of the performance and efficiency of high performance aircraft. Conducts aeronautical flight research and technology projects, including joint and/or cooperative activities with other **NASA** Installations, Government agencies, and industry.

Strengthen basic research and technology development for aerospace systems that transport humans, and instrumentation to and from space and within the atmospheres of other bodies within the solar system. Conducting transatmospheric research activities which focus on developing wind tunnel and flight analysis for use in evaluating the performance of hypersonic vehicles.

SAFETY, RELIABILITY *AND* QUALITY ASSURANCE - Provide institutional safety and health programs and develop and integrate Safety, Reliability and Quality Assurance guidelines into program and project development.

CENTER MANAGEMENT *AND* OPERATIONS - Provide administrative and financial services in support of Center management and provides for the operation and maintenance of the institutional facilities, systems, and equipment.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
AMES RESEARCH CENTER

	FY 1994	FY 1995	FY 1996
Space station	0	0	0
U.S./Russian cooperative program	0	0	0
Space shuttle/payload and utilization operations	1	0	0
Space science	146	145	145
Physics and astronomy	102	101	101
Planetary exploration	44	44	44
Life and microgravity sciences and applications	188	185	184
Mission to planet earth	70	71	72
Aeronautical research and technology	727	713	717
Space access and technology	95	99	96
Academic programs	3	3	3
Safety, reliability and quality assurance	14	14	14
Mission/space communication services	7	6	6
Subtotal, direct full-time permanent FTEs	1,251	1,236	1,237
Center management and operations	457	442	440
Subtotal, full-time permanent FTEs	1,708	1,678	1,677
Other controlled FTEs	59	72	73
Total, full-time equivalents	1,767	1,750	1,750*

* During 1995, each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1996 ESTIMATES

DRYDEN FLIGHT RESEARCH CENTER

CENTER ROLES AND MISSIONS

SPACE SHUTTLE/PAYLOAD AND UTILIZATION OPERATIONS - Provide operational and technical support for the conduct of Space Shuttle missions, including on-orbit tracking and communications, landing support of crew and science requirements. Provides flight test support for atmospheric tests of experimental or developmental launch systems.

AERONAUTICAL RESEARCH AND TECHNOLOGY - Develop, manage, and maintain facilities and testbed aircraft to support safe, timely, and cost effective NASA flight research and to support industry, university, and other government agency flight programs.

Conceive, formulate, and conduct piloted and unpiloted flight research programs in disciplinary technology, integrated aeronautical systems, and advanced concepts to meet current and future missions throughout subsonic, supersonic, and hypersonic flight regimes.

Canyout flight research programs in cooperation with other NASA Installations, other government agencies, the aerospace industry, and universities. Transitions results, techniques, methods, and tools to industry and Government users in a timely manner.

CENTER MANAGEMENT AND **OPERATIONS** - Provide administrative and financial services in support of Center management and provides for the operation and maintenance of the institutional facilities, systems and equipment.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
DRYDEN FLIGHT RESEARCH CENTER

	FY 1994	FY 1995	FY 1996
Space station	0	0	0
U.S./Russian cooperative program	0	0	0
Space shuttle/payload and utilization operations	24	21	18
Space science	0	0	0
Physics and astronomy	0	0	0
Planetary exploration	0	0	0
Life and microgravity sciences and applications	0	0	0
Mission to planet earth	0	0	0
Aeronautical research and technology	298	313	317
Space access and technology	0	0	0
Academic programs	3	3	3
Safety, reliability and quality assurance	0	0	0
Mission/space communication services	18	19	19
Subtotal, direct full-time permenent FTEs	343	356	357
Center management and operations	88	104	103
Subtotal, full-time permanent FTEs	431	460	460
Other controlled FTEs	24	21	21
Total, full-time equivalents	455	481	481*

* During 1995, each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1996 ESTIMATES

LEWIS RESEARCH CENTER

ROLES AND MISSIONS

SPACE STATION - The Lewis Research Center (LeRC)provides engineering and testbed support to the program. This includes test capabilities, the provision of Government Furnished Equipment (GFE), and engineering analysis support for the work of the prime contractor, its major subcontractors, and NASA system engineering and integration efforts.

LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS - Conduct microgravity science and applications research; design and develop space flight experiments: and perform ground and space flight experiments in materials, combustion, fluid physics, and instrumentation. Perform research on advanced design and operation of microgravity experimental flight hardware. Conduct ground-based research and flight experiments in basic science and technology associated with materials, combustion, fluid physics phenomena, and power and propulsion technology.

SPACE ACCESS AND TECHNOLOGY - Conduct research to provide advancements in satellite, platform and planetary power systems; to create new propulsion options for high- and low-thrust systems; to enable new capabilities in space communications and electronics; and to provide effective means to manage cryogenic fluids in microgravity. Conduct research in propulsion to support the next generation of unmanned launch vehicles, satellites, microsatellites, and space platforms. Conduct research on enhanced micro- and full-size satellite power systems as well as power systems for deep space and planetary exploration.

Perform applied research and technology aimed at development of advanced concepts and technologies for communication systems. Emphasis is on developing high data return from NASA missions using less mass and power and developing innovative and cost competitive commercial satellite communications services.

Conduct space materials and structures research and technology to develop improved materials, advance structural analysis and life prediction, and develop long-life, reliable space mechanisms.

Promote and develop private sector investment in space-based technologies and to promote industrial productivity through the transfer of technologies that derive from NASA's programs and activities.

Conduct studies to provide long-range planning for future launch systems and spacecraft. Provide technology assessments & technology definition studies for future space operations in the areas of telecommunications and information management networks.

The LeRC is responsible for procurement and management of commercial launch services for the intermediate (Atlas/Centaur and Titan III) and large (Titan IV) class expendable launch vehicles in the NASA Mixed Fleet.

AERONAUTICAL RESEARCH AND TECHNOLOGY - Conduct aerospace propulsion research and technology to enhance the technology base for developing advanced aeronautical propulsion systems in order to increase speed and range; improve fuel efficiency, operating cost, reliability and durability: and decrease environmental impact.

Conduct vehicle focused research and technology directed at developing the propulsion technology for specific engines and propulsion systems. Applications for these focused propulsion systems research efforts include subsonic transports, commuters, supersonic cruise (High Speed Research), hypersonic aircraft, rotorcraft, general aviation, and high performance aircraft.

CENTER MANAGEMENT AND OPERATIONS - Provides administrative and financial services in support of Center management and provides for the operation and maintenance of the institutional facilities, systems, and equipment.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM
LEWIS RESEARCH CENTER

	FY 1994	FY 1995	FY 1996
Spacestation	162	100	98
U.S./Russian cooperative program	0	0	0
Space shuttle/payload and utilization operations	0	0	0
Space science	0	0	0
Physics and astronomy	0	0	0
Planetary exploration	0	0	0
Life and microgravity sciences and applications	372	371	381
Mission to planet earth	4	0	0
Aeronautical research and technology	975	1,009	1,039
Space access and technology	607	548	520
Academic programs	14	14	14
Safety, reliability and quality assurance	7	4	4
Mission/space communication services	0	0	0
Subtotal, direct full-time permanent FTEs	2,141	2,046	2,056
Center management and operations	474	441	431
Subtotal, full-time permanent FTEs	2,615	2,487	2,487
Other controlled FTEs	69	81	81
Total, full-time equivalents	2,684	2.568	2,568*

* During 1995, each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

ROLES AND MISSIONS

SPACE SHUTTLE/PAYLOAD AND UTILIZATION OPERATIONS - Manage development of the Hitchhiker, a reusable carrier system which provides increased flight opportunities with reduced leadtime while maximizing Space Shuttle load factors and minimizing spaceflight costs. *Also* manage and coordinate the Agency's Get Away Special (GAS) program.

SPACE SCIENCE

Physics and Astronomy - The GSFC manages activities in the following discipline areas: gamma ray astronomy, X-ray astronomy, ultraviolet and optical astronomy, infrared and radio astronomy, particle astrophysics, solar physics, interplanetary physics, planetary magnetospheres, and astrochemistry. The GSFC is also responsible for conducting the mission operations for a variety of operating spacecraft. Other activities include managing NASA's sounding rocket and scientific balloon program.

Planetary Exploration - Conducts research into the physics of interplanetary and planetary space environments. Participates in planetary mission instrument development, operations, and data analysis.

MISSION TO PLANET EARTH - Development of the Earth Observing System (EOS). The primary objective of the EOS is to record global change and to observe regional-to-global processes . The EOS will document global change over a fifteen year period to provide long-term, consistent data sets for use in modeling and understanding global processes. This process and modeling research effort will provide the basis for establishing predictive global change models for policy makers and scientists.

Manage Earth Probes flight projects and develop and operate weather satellite missions for the National Oceanic and Atmospheric Administration (NOAA) and conduct correlation measurements from balloons, sounding rockets, aircraft, and ground installations.

SPACE ACCESS AND TECHNOLOGY - Develop technologies targeted at improved space borne instruments, and on-board spacecraft systems and subsystems. The GSFC is involved in flight test and demonstration of the integration of new technology on the Space Shuttle and Expendable Launch Vehicle (ELV) systems. Promote private sector investment in space-based technologies through the transfer of technologies that derive from NASA's programs and activities. Manages the small and medium class ELV such as Pegasus and Delta used to put a wide variety of spacecraft into a broad spectrum of orbits.

AERONAUTICAL RESEARCH AND TECHNOLOGY - The Wallops Flight Facility conducts flight studies of new approach and landing procedures using the latest in guidance equipment and techniques, pilot information displays, human factors data, and terminal area navigation.

MISSION/SPACE COMMUNICATION SERVICES - Research and technology involves the investigation and development of advanced systems and techniques for spacecraft communications and tracking, command and control, and data acquisition and processing. The primary objectives are to apply technology and develop advanced capabilities to meet the tracking and data processing requirements of new missions and to improve the cost effectiveness and reliability of flight mission support.

Operates the Tracking and Data Relay Satellite System (TDRSS); manages the development of the replenishment TDRS spacecraft; provides mission control, data processing, and orbit/attitude computation support; operates the Space Tracking and Data Network (STDN), the NASA Communications (NASCOM) Network, and the Aeronautics, Balloons and Sounding Rocket Program.

The NASCOM Network links the stations of the Deep Space Network (DSN), STDN, TDRSS, and other tracking and data acquisition elements with control centers and data processing and computation centers.

CENTER MANAGEMENT AND OPERATIONS - Provides administrative and financial services in support of Center management and provides for the operation and maintenance of the institutional facilities, systems, and equipment.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY R
GODDARD SPACE G CENTER

	FY 1994	FY 1995	FY 1996
Space station	0	0	0
U.S./Russian cooperative program	0	0	0
Space shuttle/payload and utilization operations	41	43	49
Space science	1,356	1,298	1,220
Physics and astronomy	1,216	1,154	1,089
Planetary exploration	140	144	131
Life and microgravity sciences and applications	0	0	0
Mission to planet earth	1,019	1,071	1,119
Aeronautical research and technology	24	28	28
Space access and technology	110	125	114
Academic programs	5	5	5
Safety, reliability and quality assurance	13	13	11
Mission/space communication services	564	525	543
Subtotal, direct full-time permanent FTEs	**3,132**	**3,108**	**3,089**
Center management and operations	707	702	717
Subtotal, full-time permanent FTEs	**3,839**	**3,810**	**3,806**
Other controlled **FTEs**	87	93	97
Total, full-time equivalents	**3,926**	**3,903**	**3,903***

* During 1995, each **NASA** Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995: revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

RESEARCH AND PROGRAM MANAGEMENT

FISCAL YEAR 1996 ESTIMATES

HEADQUARTERS

ROLES AND MISSIONS

The mission of Headquarters is to plan and provide executive direction for the implementation of U.S. space and aeronautics programs consistent with the objectives stated in the National Aeronautics and Space Act of 1958, as amended. Responsibilities include providing a balanced Agency workforce capable of planning, formulating, and advocating executive direction to national programs to implement the above objectives. The following offices at Headquarters assist in carrying out the technical aspects of the mission:

Office of Space Flight (OSF) - Plans, directs, executes, and evaluates the acquisition and operations of space flight programs including the Space Shuffle and other space flight related programs. The Office of Space Flight oversees improvements in safety, reliability, and effectiveness of Space Shuttle operational performance: and manages a variety of programs such as Spacelab. Payload Operations and Support Equipment. Manages the design, development, test, and evaluation of the Space Station program.

Office of Space Science (OSS) - Responsible for research and development efforts utilizing a variety of flight system and ground based observatories to increase knowledge of the universe. Office of Space Science research and development activities are carried out in Planetary Exploration, Astrophysics, and Space Physics. The Planetary Exploration program studies our solar system, including the planets and their satellites, comets, and asteroids. The Astrophysics program studies the universe beyond our solar system, including galaxies, stars, and exotic objects such as quasars, neutron stars, pulsars, and black holes. The Space Physics program studies naturally occurring plasmas, including the hot plasma of the sun, Earth's and other planets' magnetospheres, the relatively cool plasmas in the planetary ionospheres, and galactic cosmic-ray plasmas.

Office of Mission to Planet Earth (OMTPE) - Responsible for research and development efforts utilizing a variety of flight system and ground based observatories to increase the scientific understanding of the total Earth system and its vulnerability to both human and natural forces of change through studies of interactions among the Earth's oceans, land, ice, atmosphere, and human activities. The Mission to Planet Earth program provides space observations for these studies, extends the national capability to predict environmental phenomena, both short and long-term, and explores the potential of remote sensing technologies to provide early warning of impacts of environmental variability on regional food, fuel, water resources and biodiversity.

Office of Life and Microgravity Sciences and Applications (OLMSA) - Responsible for research and development efforts utilizing a variety of flight system and ground based observatories to increase knowledge in Life and Microgravity Sciences. The Life Sciences research program results are applied to maintaining astronaut health and productivity; understanding the response of

biological mechanisms to weightlessness; study of basic cellular, development, and physiological processes; development of environmental health requirements and support systems for long-term piloted space flight. The Microgravity Research program is aimed at utilizing the low gravity environment to obtain new knowledge and understanding of those physical phenomena made obscure by the effects of gravity and to increase understanding of gravity-dependent phenomena. Responsibilities also include the Space Shuttle/Spacelab and attached payload mission management activities.

- **Office of Aeronautics** - Plans, directs, executes, and evaluates the aeronautical research and technology programs. The goal of the aeronautical programs is to conduct research and develop technology to strengthen U.S. leadership in civil and military aviation. The program is based on a strong commitment to develop a broad technology base to support the global competitive posture and economic strength of the aviation industry, to enhance safety and capacity of the national airspace system, and to assure U.S. aviation superiority for national security.

Office of Space Access and Technology (OSAT) - Promotes innovative space technologies and the transfers of those technologies to aerospace and non-aerospace applications. The OSAT is responsible for planning and assessing technology development requirements and providing management of these activities across the Agency. The programs develop partnerships with industry, academia, and other Government agencies to advance the research and development of space technologies and applications; further space transportation and launch vehicle technology and development; provide for the transport of NASA technology to industry and academia; and promote and facilitate commercial space development and applications. Responsibilities also include the procurement of Expendable Launch Vehicle Services for NASA and other civil Government programs.

Office of Space Communications - Provides the vital tracking, telemetry, command, data acquisition, communications, and data processing required by all NASA flight projects. Included in Earth orbital activities are the Space Transportation System (STS), Spacelab, and scientific and applications missions. The various capabilities provided include: (a) tracking to determine the position and trajectory of vehicles in space; (b) acquisition of science and space applications data from on-board experiments and sensors; (c) acquisition of engineering data on the performance of spacecraft and launch vehicle systems; (d) reception of television transmissions from space vehicles; (e) transmissions of commands from ground facilities to the spacecraft; (f) voice communications with astronauts; (g) transfer of information between the various ground facilities and control centers; and (h) processing of data acquired from the launch vehicles and spacecraft. These capabilities are essential for operating and maintaining U.S. space assets to achieve the scientific objectives of all flight missions and for executing the critical decisions necessary to the success of these missions.

Office of Safety and Mission Quality (OSMQ) - Assures NASA mission safety through the development, implementation, and oversight of uniform safety, reliability, maintainability, technical standards, improving program assurance, and quality assurance policies and procedures.

Center Management and Operations - This category is composed of two major groups of Headquarters employees. The first group includes all the functional and staff offices which provide Agencywide guidance and oversight in areas such as procurement, personnel, financial management, supply and logistics, equal opportunity, international relations, and management systems and facilities.

The second major group includes the employees whose primary task is to provide direct support to the Headquarters staff by providing day-to-day operations in procurement, personnel, financial, and other administrative functions.

DISTRIBUTION OF FULL-TIME EQUIVALENT (FTE) WORKYEARS BY PROGRAM HEADQUARTERS

	FY 1994	FY 1995	FY 1996
Space station	54	34	34
U.S./Russian cooperative program	5	5	5
Space shuttle/payload and utilization operations	107	109	109
Space science	126	118	118
Physics and astronomy	65	59	59
Planetary exploration	61	59	59
Life and microgravity sciences and applications	78	78	78
Mission to planet earth	90	77	77
Aeronautical research and technology	83	83	83
Space access and technology	145	139	114
Academic programs	31	31	31
Safety, reliability and quality assurance	83	83	83
Mission/space communication services	71	68	58
Subtotal, direct full-time permanent FTEs	873	825	790
Center management and operations	903	886	874
Subtotal, full-time permanent FTEs	1,776	1,711	1,664
Other controlled FTEs	111	115	115
Total, full-time equivalents	1.887	1.826	1,779*

* During 1995, each NASA Installation is undergoing a workforce review including both civil servants and contractor support. It is anticipated that the preliminary conclusions from this review will be reached by mid-1995; revised estimates for FTE distribution by installation and by program will be provided as soon as possible after the review is completed.

DETAIL OF PERMANENT POSITIONS

	FY 1994	FY 1995	FY 1996
Executive level II	1	1	1
Executive level III	0	0	0
Executive level IV	1	1	1
Executive level V	0	0	0
subtotal	**2**	**2**	**2**
Es-6	54	60	58
Es-5	98	110	105
Es-4	239	269	256
ES-3	39	44	42
Es-2	32	36	34
Es-1	37	42	40
subtotal	**499**	**561**	**535**
CA	1	1	1
SL/ST	61	61	60
GS/GM-15	2,411	2,393	2.385
GS/GM-14	3,719	3,691	3,679
GS/GM-13	6,293	6,246	6,225
GS-12	3,273	3,249	3,238
GS-11	1,701	1,688	1,683
GS-10	314	312	311
GS-09	719	714	711
GS-08	310	308	307
GS-07	884	877	874
GS-06	658	653	651
GS-05	669	664	662
GS-04	117	116	116
GS-03	12	12	12
GS-02	6	6	6
GS-01	0	0	0
Subtotal	**21,148**	**20,991**	**20.921**
Special ungraded positions established by NASA Administrator	19	19	19
Ungraded positions	564	560	558
Total permanent positions	**22.232**	**22.133**	**22.035**
Unfilled positions, EOY	0	0	0
Total permanent employment, EOY	**22.232**	**22.133**	**22.035**

PERSONNEL SUMMARY

	FY 1994	FY 1995	FY 1996
Average GS/GM grade	12.0	12.0	12.0
Average ES salary	$111.594	$115,176	$118,873
Average GS/GM salary	$54,829	$56,589	$58,406
Average salary of special ungraded positions established by NASA Administrator	$96.463	$99,559	$102,755
Average salary of ungraded positions	$39,421	$40,686	$41.992

CENTER LOCATIONS AND CAPITAL INVESTMENT

JOHNSON SPACE CENTER - The Lyndon B. Johnson Space Center is located 20 miles southeast of Houston, Texas. NASA owns 1,618 acres of land at the Houston site and uses another 60.552 at the White Sands Test Facility, Las Cruces, New Mexico. The total capital investment including land, buildings, structures and facilities, equipment, and other fxed assets was $1,339,360,000 as of September 30, 1994.

KENNEDY SPACE CENTER - The Kennedy Space Center is located 50 miles east of Orlando, Florida. NASA owns 82,943 acres and uses launch facilities at Cape Canaveral *Air* Station and Vandenberg *Air* Force Base. The total capital investment including land, buildings, structures and facilities, equipment, and other fxed assets was $2,292,664,000 as of September 30, 1994.

MARSHALL SPACE FLIGHT CENTER - The Marshall Space Flight Center is located within the U.S. Army's Redstone Arsenal at Huntsville, Alabama. The total capital investment including land, buildings, structures and facilities, equipment, and other fixed assets was $1,580,919,000 as of September 30, 1994.

STENNIS SPACE CENTER - The Stennis Space Center is located approximately 50 miles northeast of New Orleans, Louisiana. NASA owns 20,588 acres and has easements covering an additional 118,284 acres. The total capital investment including land, buildings, structures and facilities, equipment, and other fxed assets was $502,428,000 as of September 30. 1994.

AMES RESEARCH CENTER - The Ames Research Center is located south of San Francisco on Moffett Field, California. The Dryden Flight Research facility is located 65 miles northeast of Los Angeles at Edwards *Air* Force Base. The Dryden facility was under the operation of Ames until a decision was made in early 1994 that each facility will operate under separate management. NASA owns 429.9 acres at the Moffett Field location. The total capital investment including land, buildings, structures and facilities, equipment, and other fixed assets at both locations was $1,093,601,000 as of September 30, 1994.

DRYDEN FLIGHT RESEARCH CENTER - The Dryden Flight Research Center is 65 air miles northeast of Los Angeles. Dryden is located at the north end of Edwards Air Force Base on 838 acres of land under a permit from the Air Force. The total capital investment at Dryden, including fxed assets in progress and contractor-held facilities at various locations, as of September 30, 1994, was $204,690,000.

LANGLEY RESEARCH CENTER - The Langley Research Center is adjacent to Langley *Air* Force Base which is located between Williamsburg and Norfolk at Hampton, Virginia. NASA owns 807 acres and has access to 3,276 acres. The total capital investment including land, buildings, structures and facilities, equipment, and other fxed assets was $1,108,014,000 as of September 30. 1994.

LEWIS RESEARCH CENTER - The Lewis Research Center occupies two sites: the main site is in Cleveland, Ohio, adjacent to Cleveland-Hopkins Airport: the second site is the Plum Brook Station located south of Sandusky, Ohio, and 50 miles west of Cleveland. NASA owns 6,820 acres and leases an additional 14 acres at the Cleveland location. The total capital investment including land, buildings, structures and facilities, equipment, and other Axed assets at both locations was $831,796,000 as September 30, 1994.

GODDARD SPACE FLIGHT CENTER - The Goddard Space Flight Center is located 15 miles northeast of Washington, D.C. at Greenbelt, Maryland. NASA owns 1,106 acres at this location and an additional 6,176 acres at the Wallops Flight Facility in Wallops Island, Virginia. The total capital investment including land, buildings, structures and facilities, equipment, and other fixed assets at both locations was $1,168,354,000 as of September 30, 1994.

HEADQUARTERS - Headquarters is located at Two Independence Square, 300 E St. SW, Washington, DC and occupies other buildings in the District of Columbia, Maryland, and Virginia.


Construction of
Facilities

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1996 ESTIMATES

TABLE OF CONTENTS

Summary Information

MISSION SUPPORT

CONSTRUCTION OF FACILITIES

FISCAL YEAR **1996** BUDGET ESTIMATES

PROGRAM GOALS

The goal of the Construction of Facilities program is to provide the facilities that are critical to achieving NASA's space and aeronautics program.

STRATEGY FOR ACHIEVING GOALS

In keeping with last year's budget restructuring, funding for construction is budgeted in the appropriations which require specific facilities to conduct their programs. Funds for discrete projects, that are required to conduct specific Human Space Flight or Science, Aeronautics, and Technology programs or projects are included in these two appropriations. The Construction of Facilities budget line item in the Mission Support appropriation provides for discrete projects required for components of the basic infrastructure and institutional facilities. The Mission Support appropriation also includes minor projects (repair, rehabilitation, and modification of existing facilities and minor construction projects), environmental compliance and restoration activities; the design of facilities projects; and advanced planning related to future facilities needs. The narratives for all construction projects are included in this portion of the budget submission to identify the total facilities required in FY **1996.** The program budgets in the Human Space Flight and Science, Aeronautics, **and** Technology appropriations include the specific facility projects as program requirements and reference the narratives provided in Mission Support for detailed descriptions and justifications.

In Human Space Flight, the FY **1996** budget request provides the second and final increment of funding for acquisition of a Neutral Buoyancy Laboratory (NBL) in support of the Space Station. NASA has recently negotiated a firm fixed-price lease/purchase agreement in the amount of **$35** million with McDonnell Douglas Corporation for the Clear Lake Development Facility (CLDF) and the construction of the NBL. The $20.2 million appropriated in FY **1995** will be used to implement the lease/purchase agreement and the modification of the CLDF for the NBL. The **$14.8** million requested in FY **1996** will be used to complete the acquisition. The Congressional Committees have been formally advised of this plan. In support of the Space Shuttle at the Kennedy Space Center, funding is included to replace the substandard Chemical Analysis Facility with an efficient facility that meets environmental and safety standards; to provide a replacement of the inadequate Space Shuttle Main Engine Processing Facility outside the Vehicle Assembly Building (VAB) to eliminate

conflicts with Solid Rocket Motor stacking and movement activities which require evacuation of the VAB to meet mandatory safety requirements; and to replace deteriorated pumps, motors, pipes, and associated control system hardware in the Firex System at Launch Complexes **39A** and **39B.**

The FY **1996** request for Science, Aeronautics and Technology provides for completing two projects begun in prior years to meet mission requirements. Included are the modernization of the Ames Unitary Plan Wind Tunnel Complex, the most heavily used wind tunnel complex in **NASA,** and the construction of the Earth Systems
• Science Building at the Goddard Space Flight Center to support the Earth Observing System (EOS) Program. It also includes construction of an addition to the Microgravity Development Laboratory at the Marshall Space Flight Center to provide laboratories and clean rooms for developing and processing microgravity experiment flight hardware.

In Mission Support, funding is requested in FY **1996** for discrete projects to repair and modernize utility and building systems which have reached or exceeded their normal design life, including heating, cooling, mechanical, air, and electrical distribution facilities at Ames Research Center, Goddard Space Flight Center, Jet Propulsion Laboratory, Johnson Space Center, Kennedy Space Center, Lewis Research Center, Marshall Space Flight Center, Wallops Flight Facility, and White Sands Test Facility. **Also** included is a project at the Stennis Space Center to restore the navigational canal lock which is critical to the continued operation of the barge transportation system.

These facilities are critical to the development and operation of the space transportation system, and support of the payloads and launch facilities as well as our aeronautical and aerospace testing capabilities to support military and private industry users.

The FY **1996** construction program is required to help preserve and enhance the capabilities and usefulness of existing facilities and ensure safe, economical, and efficient use of the NASA physical plant. This request continues the necessary rehabilitation and modification program begun in prior years and continues a responsive repair program. The minor construction program provides a means to accomplish smaller facility projects which accommodate changes in technical and institutional requirements. The environmental compliance and restoration program is critical to ensuring that statutory environmental requirements are met and that necessary remedial actions are promptly taken.

Funds requested for facility planning and design cover advance planning and design requirements for potential future projects, master planning, facilities studies, engineering reports and studies, and the preparation of facility project design drawings and bid specifications.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1996 ESTIMATES
SUMMARY OF THE BUDGET PLAN BY LOCATION
(Thousands of Dollars)

LOCATION	Fiscal Year 1994	Fiscal Year 1995	Fiscal Year 1996 Agency Request
Ames Research Center	64.402	31.800	23.530
Dryden Flight Research Center	3.760	11.210	3.320
Goddard Space Flight Center	32.258	27.110	26.785
Jet Propulsion Laboratory	10.820	10.910	13.300
Lyndon B. Johnson Space Center	21.433	30.350	28.155
John F. Kennedy Space Center	40.663	23.450	32.300
Langley Research Center	69.551	9.020	8.295
Lewis Research Center	55.870	9.650	19.265
George C. Marshall Space Center	36.390	23.675	31.640
John C. Stennis Space Center	14.505	4.280	8.800
Wallops Flight Facility	12.285	4.320	6.890
Various Locations	97.446	8.955	10.580
Headquarters	5.817	1.770	1.140
Facility Planning and Design	21.500	10.000	10.000
Total Construction of Facilities	492.700	206.500	224.000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1996 ESTIMATES
BUDGET PLAN BY APPROPRIATION *AND* PROJECT
(Thousands of Dollars)

INSTALLATION AND PROJECT	Fiscal Year 1994	Fiscal Year 1995	Fiscal Year 1996 Agency Request	Page No
HUMAN SPACE FLIGHT				
SPACE STATION:	---	20,200	14,800	
Construction of Neutral Buoyancy Laboratory (JSC)	---	20,200	14,800	CF 1-1
OTHER HUMAN SPACE FLIGHT:	34,300	12,300	17,400	
Replace Chemical Analysis Facility (KSC)	---	---	7,500	CF 1-5
Replace Space Shuttle Main Engine Processing Facility (KSC)	---	---	4,900	CF 1-9
Modernize Firex System, Pads A and B (KSC)	---	4,800	5,000	CF 1-13
Replace Components Refurbishment Laboratory (KSC)	---	7,500		
Replace Mission Control Air Handlers (JSC)	8,000	---	---	
Replace Thermal Vacuum Helium Refrigeration Systems (JSC)	7,400	---	---	
Modify Launch Complex 39 Exterior Utility Piping (KSC)	600	---	---	
Refurbish Launch Complex 39 Cooling System (KSC)	4,000	---	---	
Refurbish Launch Complex 39 Secondary Circuit Breakers (KSC)	3,300	---	---	
Restore C-5 Substation, Launch Complex 39 Area (KSC)	5,000	---	---	
Restore B-1 Test Complex (SSC)	6,000	---	---	
Total - Human Space Flight	34,300	32,500	32,200	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1996 ESTIMATES
BUDGET PLAN BY APPROPRIATION AND PROJECT
(Thousands of Dollars)

INSTALLATION AND PROJECT	Fiscal Year 1994	Fiscal Year 1995	Fiscal Year 1996 Agency Request	Page No.
SCIENCE, AERONAUTICS, AND TECHNOLOGY				
SCIENCE	33,600	17,000	20,000	
Construction of Earth Systems Science Building (GSFC)	12,000	17,000	17,000	CF 2-1
Construction of Addition to Microgravity Development Laboratory (MSFC)	---	---	3,000	CF 2-5
Construction of EOSDIS Distributed Active Archive Center (DAAC) (LaRC)	6,000	---	---	
Construction of 34-Meter Multifrequency Antenna, Canberra, Australia (JPL)	11,600	---	---	
Construction of 34-Meter Multifrequency Antenna, Madrid, Spain (JPL)	4,000	---	---	
AERONAUTICS	203,000	22,000	5,400	
Modernization of the Unitary Plan Wind Tunnel Complex (ARC)	25,000	22,000	5,400	CF 2-9
National Aeronautics Facilities Upgrade Program (Various Locations)	172,000	---	---	
Rehabilitation of Control Systems, National Full-scale Aerodynamics Complex (ARC)	2,100	---	---	
Upgrade of Outdoor Aerodynamic Research Facility (ARC)	3,900	---	---	
TECHNOLOGY	12,500	---	---	
Rehabilitation of Rocket Engine Test Facility (LeRC)	12,500	---	---	
Total - Science, Aeronautics, and Technology	**249,100**	**39,000**	**25,400**	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1996 ESTIMATES
BUDGET PLAN BY APPROPRIATION AND PROJECT
(Thousands of Dollars)

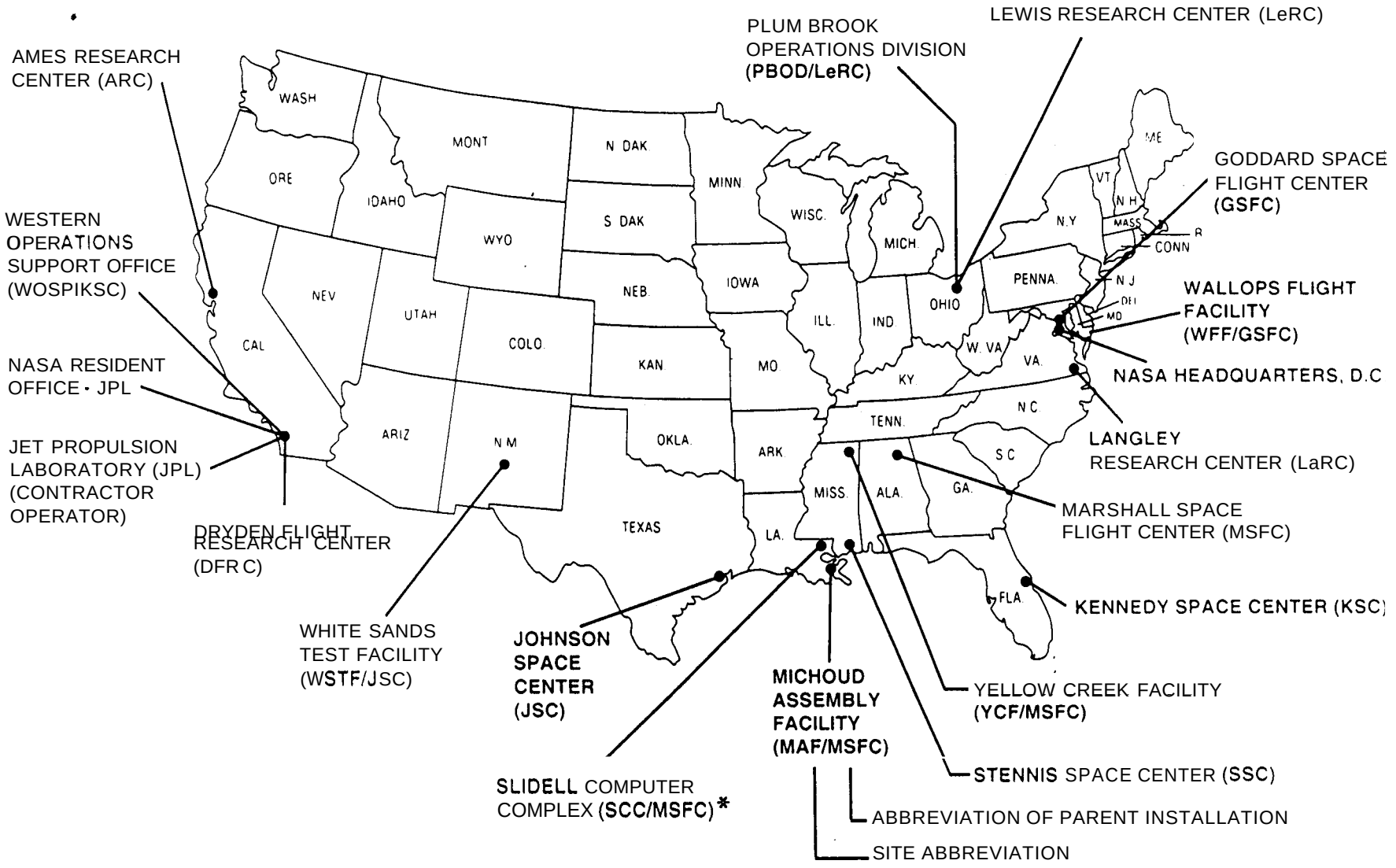
INSTALLATION AND PROJECT	Fiscal Year 1994	Fiscal Year 1995	Fiscal Year 1996 Agency Request	Page No
MISSION SUPPORT				
Restoration of Flight Systems Research Laboratory (ARC)	---	---	6,300	CF 3.1-1
Restoration of Chilled Water Distribution System (GSFC)	5,000	---	3,000	CF 3.1-7
Replace Chillers, Various Buildings (JPL)	2,900	---	4,800	CF 3.1-10
Rehabilitation of Electrical Distribution System, White Sands Test Facility (JSC)	---	---	1,100	CF 3.1-13
Replace Main Substation Switchgear and Circuit Breakers (JSC)	---	---	4,200	CF 3.1-16
Replace 15kV Load Break Switches (KSC)	---	---	1,800	CF 3.1-19
Rehabilitation of Central Air Equipment Building (LeRC)	---	---	9,000	CF 3.1-22
Restoration of High Pressure Air Compressor System (MSFC)	8,500	---	4,700	CF 3.1-25
Restoration of Information and Electronic Systems Laboratory (MSFC)	---	---	6,800	CF 3.1-28
Restoration of Canal Lock (SSC)	---	---	1,400	CF 3.1-31
Restoration of Primary Electrical Distribution System (WFF)	---	---	2,500	CF 3.1-34
Seismic Upgrade of Research, Development, and Test Building (DFRC)	---	8,000	---	
Restore Exterior/Interior Systems, Buildings 3, 13, and 14 (GSFC)	---	5,000	---	
Modernize Condenser Water Systems, Southern Sector (JPL)	---	4,300	---	
Rehabilitate Utility Tunnel Structure and Systems (JSC)	---	4,300	---	
Modernize Payloads Hazardous Servicing Facility HVAC System (KSC)	---	1,500	---	
Modernize Metrology and Calibration Facility (MSFC)	---	4,900	---	
Replacement of Central Plant Steam and Electrical Generation Equipment (GSFC)	8,600	---	---	
Rehabilitate Electrical Distribution System, Project Management Building (JSC)	2,200	---	---	
Refurbish Vehicle Assembly Building/Pad Water Storage Tanks (KSC)	3,000	---	---	
Rehabilitate Industrial Area Fire Alarm Reporting System (KSC)	4,900	---	---	
Restore Class III Landfill (KSC)	1,900	---	---	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1996 ESTIMATES
BUDGET PLAN BY APPROPRIATION AND PROJECT
(Thousands of Dollars)

INSTALLATION AND PROJECT	Fiscal Year 1994	Fiscal Year 1995	Fiscal Year 1996 Agency Request	Page No
MISSION SUPPORT (Continued)				
Restoration of Electrical Power System (MSFC)	2,600	---	---	
Replace Cooling Tower and Boiler (MAF)	4,000	---	---	
Restoration of Underground Communication Distribution System (SSC)	3,000	---	---	
Restoration of Airfield (WFF)	5,200	---	---	
Repair of Facilities at Various Locations, Not in excess of $1,500,000 per project	36,000	30,000	35,000	CF 3.2
Rehabilitation and Modification of Facilities at Various Locations, Not in excess of $1,500,000 per project	36,000	30,000	35,000	CF 3.3
Minor Construction of New Facilities and Additions to Existing Facilities at Various Locations, Not in excess of $1,500,000 per project	14,000	2,000	3,800	CF 3.4
Facility Planning and Design	21,500	10,000	10,000	CF 3.5
Environmental Compliance and Restoration	50,000	35,000	37,000	CF 3.6
Total - Mission Support	**209,300**	**135,000**	**166,400**	
Total - Construction of Facilities	**492,700**	**206,500**	**224,000**	

(Total Construction of Facilities funding included in the three appropriations)

LOCATION OF MAJOR AND COMPONENT INSTALLATIONS



*Slidell Computer Complex was transferred to the City of Slidell, La. on December *14, 1994.*

RECORDED VALUE OF CAPITAL TYPE PROPERTY
IN-HOUSE AND CONTRACTOR-HELD
AS OF SEPTEMBER 30, 1994
(DOLLARS IN THOUSANDS)

REPORTING INSTALLATION	LAND	BUILDING	OTHER STRUCTURES AND FACILITIES	LEASEHOLD IMPROVEMENTS	TOTAL	EQUIPMENT	FIXED ASSETS IN PROGRESS	GRAND TOTAL
AMES RESEARCH CENTER	6,865	636,696	92[illegible]	0	735,561	422,998	139,732	1,298,291
ARC MOFFETT FIELD, CA	2,928	522,913	26,329	0	552,170	326,544	121,539	1,000,253
DRYDEN FLIGHT FACILITY EDWARDS, CA	0	63.128	27,016	0	90,144	96353	18,193	204,690
VARIOUS LOCATIONS	3,937	50,655	38,655	0	93.247	101	0	93,348
GODDARD SPACE FLIGHT CENTER	3,341	308,365	140,405	0	452.111	667,381	48,862	1,168,354
CSFCCREENBELT. MD	1,578	211,021	39,122	0	251,721	336,898	39,388	628,007
TRACKING STATIONS NETWORK	0	35,155	11,719	0	46,874	100,243	966	148,083
WFF-WALLOPS ISLAND, VA	1.763	59,304	84.788	0	145,855	83,799	8,508	238.162
VARIOUS LOCATIONS	0	2,885	4,776	0	7,661	146.441	0	154,102
JET PROPULSION LABORATORY	1.189	200,271	114,671	1,096	317,227	3,918,821	0	4,236,048
JPL PASADENA, CA	1,189	200,271	114,671	1,096	317,227	3,918,821	0	4,236,048
JOHNSON SPACE CENTER	11,256	344,021	122.351	105	477.733	835,686	25.941	1,339,360
JSC-HOUSTON, TX	7,309	289,251	78,826	0	375,386	515,171	25,941	916,498
WHITE SANDS TEST FACILITY LOS CRUCES, NM	377	15.217	37,482	105	53,181	0	0	53.181
VARIOUS LOCATIONS	3,570	39,559	6,043	0	49,172	320515	0	369,687
KENNEDY SPACE CENTER	73,672	629,905	568,601	0	1272,178	877,600	143.912	2,293,690
KSC-CAPE CANAVERAL FL	73,672	629,905	568,601	0	1,272,178	3[illegible]	143.912	1,504,692
WESTERN TEST RANGE, LOMPAC, CA	0	0	0	0	0	31 11	0	31 11
VARIOUS LOCATIONS	0	0	0	0	0	785,887	0	785,887
LANGLEY RESEARCH CENTER	156	248.527	433,201	0	681,884	350,737	75.393	1,108,014
LARC-HAMPTON, VA	156	248.527	433,201	0	681,884	340,444	75.393	1,097,721
VARIOUS LOCATIONS	0	0	0	0	0	10,293	0	10,293
LEWIS RESEARCH CENTER	2,621	334,673	120,284	136	457,714	267,542	106,540	831,796
LERC-CLEVELAND, OH	316	255,489	100,811	136	356,752	173.771	106,540	637,063
PLUMBROOK, SANDUSKY, OH	2,305	79,184	19,473	0	100,962	79,693	0	180,655
VARIOUS LOCATIONS	0	0	0	0	0	14,078	0	14,078
MARSHALL SPACE FLIGHT CENTER	11,093	496,079	248,696	0	755,868	812,048	13,003	1,580,919
MSFC-HUNTSVILLE, AL	0	208,728	103,013	0	311,741	568,789	13,003	893533
MICHOUD ASSEMBLY FACILITY, LA	7,162	166,438	89,524	0	263,124	73.326	0	336,450
SLIDELL COMPUTER COMPLEX, LA	69	5,253	3,179	0	8,501	8,040	0	16,541
VARIOUS LOCATIONS	3,862	115,660	52,980	0	172,502	161,893	0	334,395
STENNIS SPACE CENTER	18,080	134,730	244,950	0	397.760	58,135	46533	502,428
STENNIS SPACE CENTER	18,080	134,730	244,950	0	397.760	57,923	46,533	502,216
VARIOUS LOCATIONS	0	0	0	0	0	212	0	212
NASA HEADQUARTERS	0	0	0	218	218	47,085	0	47,303
NASA-HQS, WASH. DC	0	0	0	218	218	47,085	0	47,303
VARIOUS LOCATIONS	0	0	0	0	0	0	0	0
AGENCY TOTAL	**128,273**	**3,333,267**	**2,085,159**	**1,555**	**5,548,254**	**8,258,033**	**599,916**	**14,406,203**

CF SUM 9

Project Justification

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1996 ESTIMATES

SUMMARY

HUMAN SPACE FLIGHT

	Amount	Page No.
	(Dollars)	
Space Station:		
Construction of Neutral Buoyancy Laboratory, Johnson Space Center.....	14,800,000	CF 1-1
Other Human Space Flight:		
Replace Chemical Analysis Facility, Kennedy Space Center.....	7,500,000	CF 1-5
Replace Space Shuttle Main Engine Processing Facility, Kennedy Space Center.....	4,900,000	CF 1-9
Modernize Firex System, Pads A and B, Kennedy Space Center.....	5,000,000	CF 1-13
Total Human Space Flight	32,200,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Construction of Neutral Buoyancy Laboratory

INSTALLATION: Lyndon B. Johnson Space Center

FY 1996 Estimate: $14,800,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$4,515,634	$20,200,000	$24,715,634
Capitalized Investment	---	---	---
Total	$4,515,634	$20,200,000	$24,715,634

SUMMARY PURPOSE AND SCOPE:

This project provides the second and final increment of funding for acquisition of the Neutral Buoyancy Laboratory (NBL) to meet the requirements for extravehicular activity (EVA) simulations for astronaut training, EVA procedures development, and validation for the Space Station assembly and operations. NASA's FY 1995 budget for the Space Station included $20.2 million for the first increment of funds for construction of the NBL. NASA has recently negotiated a firm fixed-price lease/purchase agreement in the amount of $35 million with McDonnell Douglas Corporation for the Clear Lake Development Facility (CLDF) and the construction of the NBL. The $20.2 million appropriated in FY 1995 will be used to implement the lease/purchase agreement and the modification of the CLDF for the NBL. This $14.8 million will be used to complete the acquisition. The Congressional Committees have been formally advised of this acquisition plan.

PROJECT:

This project is required for EVA simulations for astronaut training and procedures development for the Space Station. A major critical requirement is the validation of EVA timelines to ensure that the EVA activities can be successfully carried out. Experience from several satellite retrieval/servicing EVA tasks, such as Solar Maximum, Westar/Palapa, Syncom, Intelsat-VI, and the recent Hubble Space Telescope, has clearly shown that the more realistic, complete simulations made possible by the larger pool size of the NBL will significantly increase assurance of successful and safe EVA mission operations.

Techniques developed and refined in neutral buoyancy facilities allow astronauts in space suits to perform space-related EVA operations on the ground in a way that correlates closely to actual on orbit task performance. Existing facilities were sized for existing program hardware. Larger facilities are required for the larger Space Station flight hardware assemblies. The NBL will accommodate the large space hardware portions and provide realistic EVA development and operations planning activities during the Space Station buildup and follow-on operations. There are no acceptable neutral buoyancy facilities available for providing adequate Space Station EVA evaluations and astronaut training. The NBL also will be the primary EVA facility for Space Shuttle and other program requirements.

IMPACT OF DELAY:

The NBL is required to support Space Station assembly engineering and training and will be invaluable for the assembly missions which involve significant EVA complexities. Delay in providing the NBL will seriously impact Space Station assembly and operations.

PROJECT DESCRIPTION:

The lease/purchase agreement includes the following CLDF facilities and all necessary modifications to the Assembly and Test Building (ATB) to provide an NBL within the ATB. All of the following facilities are metal panel structures that include heating, ventilation, air conditioning, associated utility services, parking, and access roadways:

- The Assembly and Test Building, approximately 101,800 gross square feet, will house the NBL with tank dimensions of approximately 202 by 102 by 40 feet.

- The Light Manufacturing Facility, approximately 98,200 gross square feet, will accommodate construction, modification, and storage for training mockups used in the NBL.

- The Avionics Development Facility, approximately 51,600 gross square feet, will provide contiguous laboratory space for avionics and associated software development, integration and testing and space for approximately 250 people associated with these operations.

A separate metal building of approximately 3,000 square feet which houses the breathing gas system will also be provided. Activation items include furniture, telephone system installation, and facility start-up supplies. The laboratory will be a steel framed structure with insulated metal panels comprising approximately 72,000 square feet. The tank will be 202 by 102 by 40 feet deep.

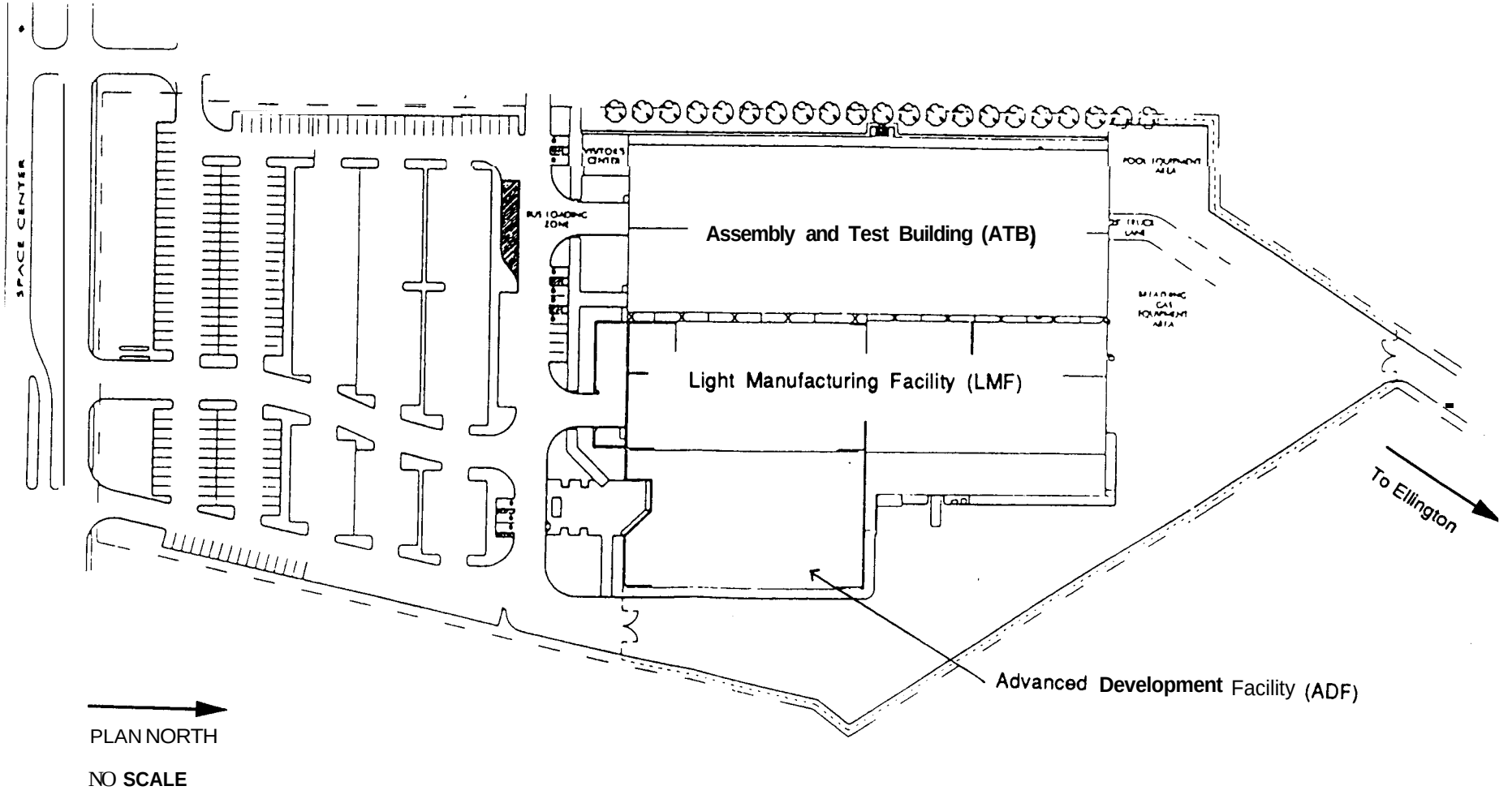
PROJECT COST ESTIMATE: Total estimated cost of the project is $35.0M. Previous funding of $20.2M was provided in FY 1995.

LIST OF RELATED GRAPHICS: Figure 1 - Lease/purchase site

FUTURE ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
CONSTRUCTION OF NEUTRAL BUOYANCY LABORATORY

LEASE/PURCHASE SITE



CF 1-4

FIGURE 1

PROJECT TITLE: Replace Chemical Analysis Facility

INSTALLATION: John F. Kennedy Space Center

FY 1996 Estimate: $7,500,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADOUARTERS OFFICE: Office of Space Flight

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$1,187,982	$7,500,000	$8,687,982
Capitalized Investment	---	---	---
Total	$1,187,982	$7,500,000	$8,687,982

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to upgrade the existing Space Shuttle Chemical Analysis Facility by replacing approximately 2,800 square meters and relocating the tanker maintenance garage.

PROJECT:

The Chemical Analysis Facility is overcrowded, does not comply with OSHA fire safety standards, has aging utility systems, and has friable asbestos in the roof deck and mechanical areas. Modifications to replace the utility systems, install fire sprinklers, install non-chlorofluorocarbon (CFC) cleaning equipment upgrades, and remove the asbestos have been canceled due to the requirement to keep this mission critical operation on-line. The facility is currently operated 7 days per week to support the chemical analysis of Space Shuttle and Air

Force flight components, and on-site institutional environmental sample analysis for KSC and Cape Canaveral Air Force Stations. In addition, the existing facility is located within the Shuttle launch impact zone requiring evacuation and subsequent work stoppage on launch days.

IMPACT OF DELAY:

Continued use of the existing facility would result in fire safety noncompliance, overcrowding, noncompliance with non-CFC cleaning equipment upgrades, and increased breakdowns of out-dated utility systems.

PROJECT:

This project provides for replacing approximately 2,800 square meters for chemical analysis labs, office area, field cleaning annex, hypergol decontamination building, warehouse, POL chemical storage building, and a hazardous waste storage building. A fire protection and detection system will be installed. Services provided will include communication, electricity, water, sewer, compressed air, and hazardous waste storage. Vapor containment equipment to supplement the existing CFC equipment will also be incorporated into this facility. Also included is the relocation of all activities associated with the maintenance of the tankers and trailers for cryogenics, gases, and other fluids used to support launch operations. The original site will also be restored to grade.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$7,500,000
Civil	LS	---	---	440,000
Structural	LS	---	---	4,380,000
Mechanical	LS	---	---	1,500,000
Electrical	LS	---	---	1,180,000
Total				$7,500,000

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan Figure 2 - Perspective

OTHER EQUIPMENT SUMMARY: $4,600,000 of analytical equipment will be provided from other program resources.

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
REPLACE CHEMICAL ANALYSIS FACILITY

LOCATION PLAN
JOHN F. KENNEDY SPACE CENTER, FLORIDA

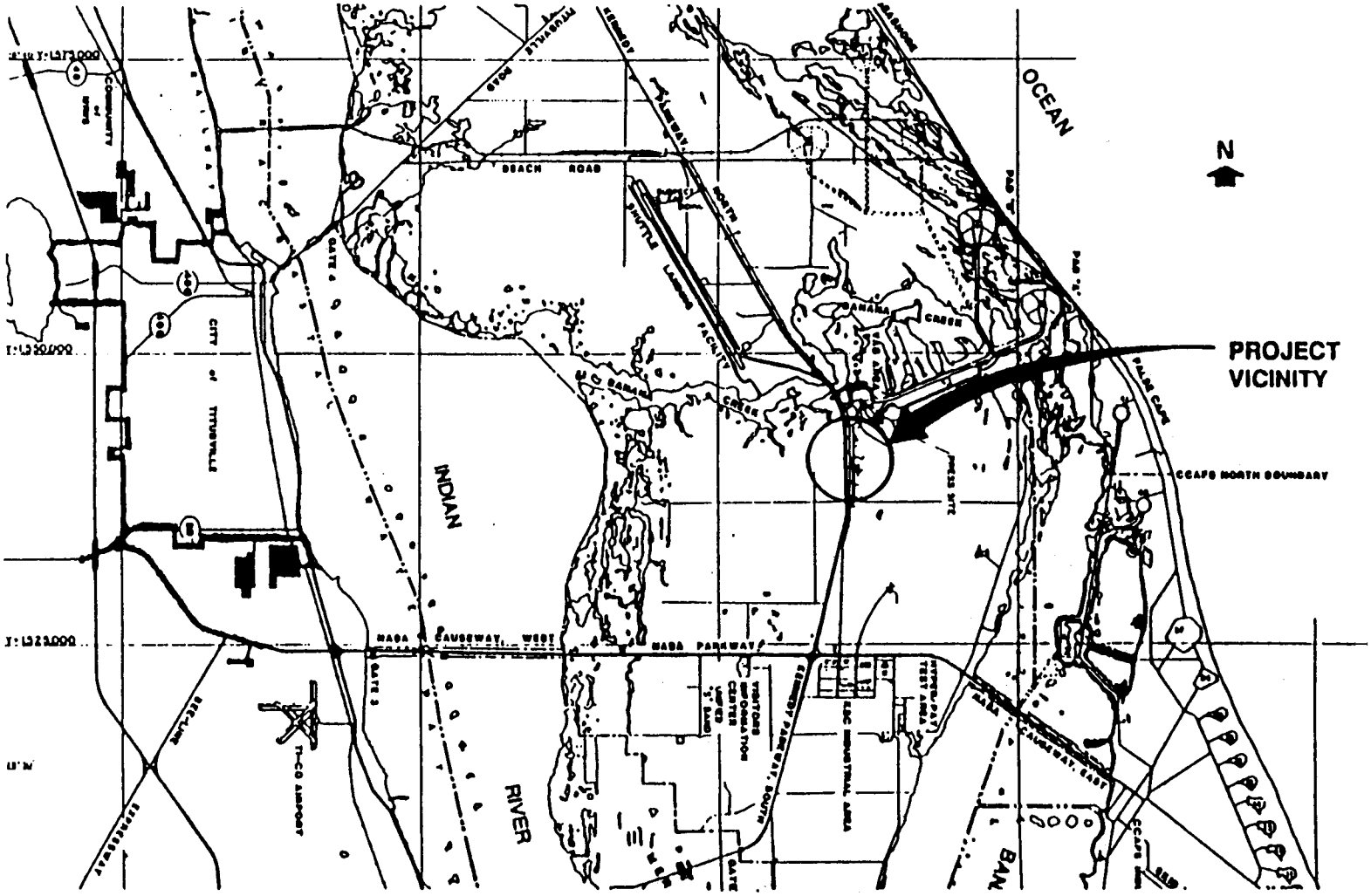


FIGURE 1

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
REPLACE CHEMICAL ANALYSIS FACILITY

PERSPECTIVE

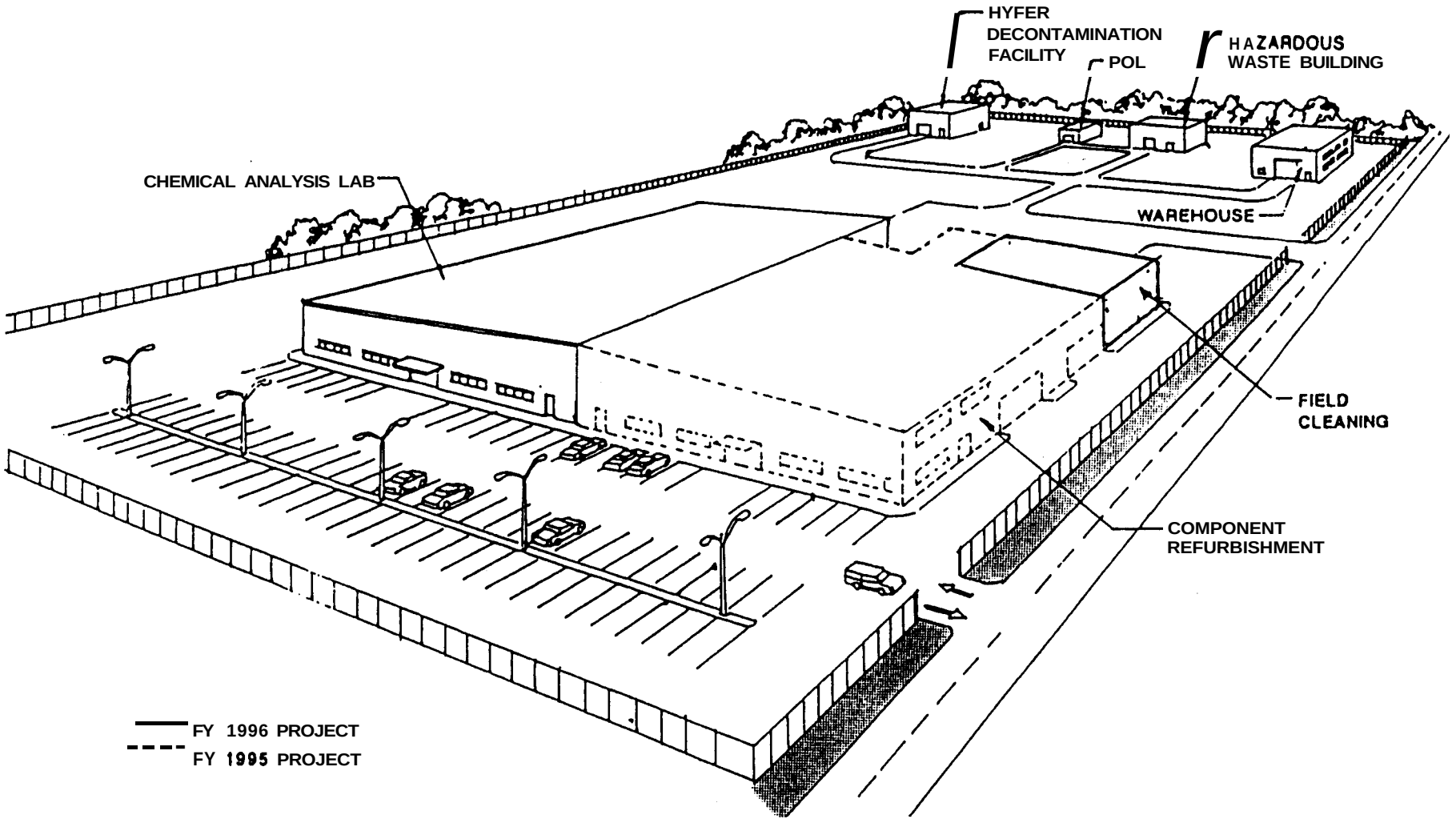


FIGURE 2

PROJECT TITLE: Replace Space Shuttle Main Engine Processing Facility

INSTALLATION: John F. Kennedy Space Center

FY 1996 Estimate: $4,900,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$493,836	---	$ 493,836
Capitalized Investment	---	$12,665,718	12,665,718
Total	$493,836	$12,665,718	$13,159,554

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to upgrade the existing Space Shuttle Main Engine (SSME) shop by replacing approximately 2,800 square meters.

PROJECT:

SSME operations at KSC are currently conducted in the Vehicle Assembly Building (VAB) low bay in an area not originally designed for those activities. The capacity of the current three vertical workstand shop is inadequate to support the volume of SSME processing. An area designed specifically for SSME processing is required to provide adequate space, optimize work and

material flow, upgrade personnel safety, preclude engine damages and improve flight hardware quality assurance.

IMPACT OF DELAY:

Any delay will continue the present risk to personnel safety and engine damage while processing SSMEs. Extremely limited space reduces engine throughput and conflicts with the VAB Abatement Plan goals. It will also continue the current costly overtime processing caused by working around Solid Rocket Motor stacking and movement schedules which require evacuation of the VAB to meet mandatory safety requirements.

PROJECT:

This project constructs a 2,800 square meter building addition to the east end of the existing Orbiter Processing Building-3 (OPF-3) Annex. It will be constructed of similar materials - steel framed and metal panel systems walls - as the OPF-3 and its low bay annex. The space will consist of three main areas: A high bay with a 15-ton overhead crane, a vertical processing area with workstands, and a 10-ton overhead crane, and ancillary storage and support space. Support requirements such as the existing security systems, storage, shops, and locker room at OPF-3 will be shared resulting in program savings.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$4,900,000
Structure	LS	---	---	3,000,000
Mechanical	LS	---	---	900,000
Electrical	LS	---	---	400,000
Cranes	LS	---	---	600,000
Total				$4,900,000

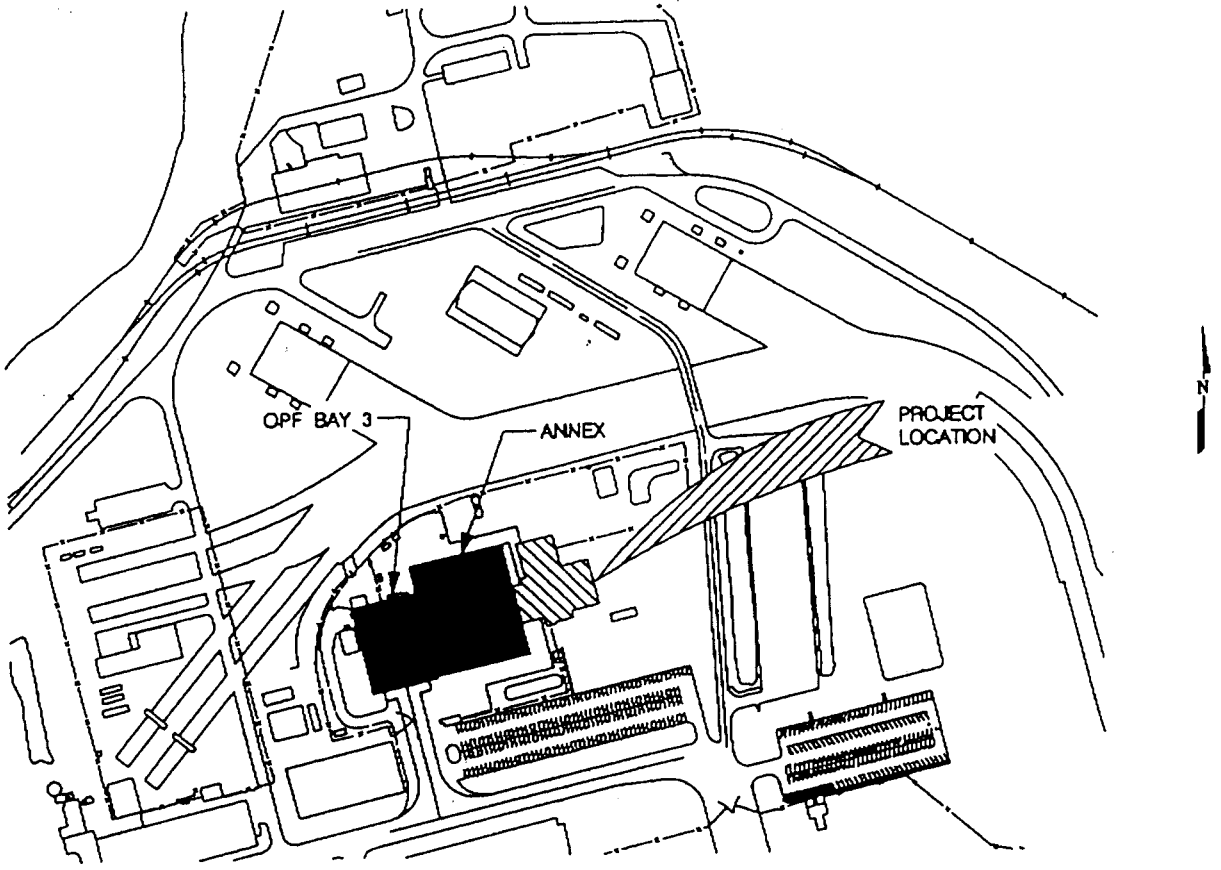
LIST OF RELATED GRAPHICS: Figure 1 - Location Plan Figure 2 - Perspective

OTHER EQUIPMENT SUMMARY: $2,500,000 of equipment will be provided from other program resources.

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
REPLACE SPACE SHUTTLE MAIN ENGINE PROCESSING FACILITY

SSME PROCESSING FACILITY

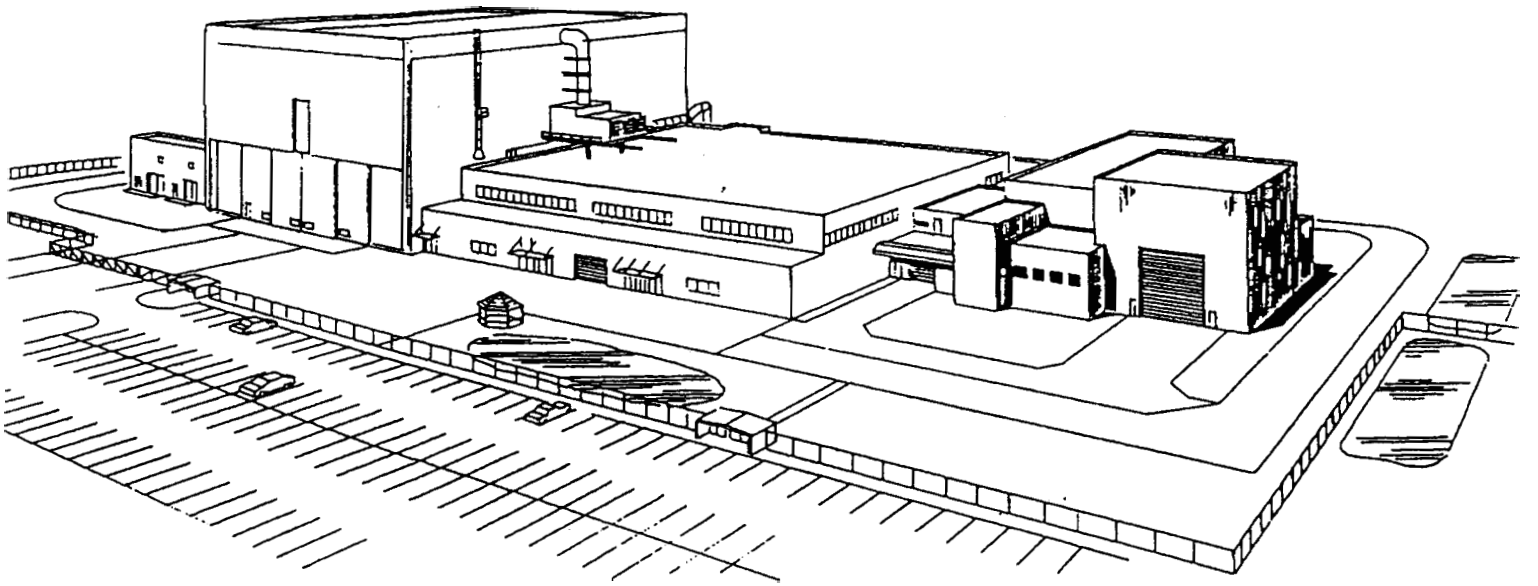


LOCATION PLAN

FIGURE 1

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
REPLACE SPACE SHUTTLE MAIN ENGINE PROCESSING FACILITY

SSME PROCESSING FACILITY



PERSPECTIVE

FIGURE 2

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Modernize Firex System, Pads A and B

INSTALLATION: John F. Kennedy Space Center

FY 1996 Estimate: $5,000,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$875,429	$ 4,800,000	$ 5,675,429
Capitalized Investment	---	216,362,462	216,362,462
Total	$875,429	$221,162,462	$222,037,891

SUMMARY PURPOSE AND SCOPE:

This project upgrades the Firex system by replacing pumps, motors, pipes, and all associated control system hardware.

PROJECT JUSTIFICATION:

The existing pumps, motors, and underground piping have deteriorated over the past 25 years. A majority of system replacement components are no longer manufactured. With the present system configuration, nominal flow rates are marginal. Pad Compressed Air System needs to be moved to

the LC-39 Water Pumping Station to avoid SRB exhaust cloud. These modifications will assure system performance over the life of the Shuttle program.

IMPACT OF DELAY:

Increasing system and component failures could render the Pad A and B Firex Protection System inadequate during an emergency. Personnel safety will be compromised and damage to the Pads could occur.

PROJECT:

This project upgrades existing Firex pumps, motors, and diesels required for system pressure specifications. Also, a new 500 mm underground pipe will be installed between the Pump Station and Pads A and B. The Pad Compressed Air System will be moved to the Water Pumping Station.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$5,000,000
Pumps	LS	---	---	2,100,000
Pipe Installation	LS	---	---	2,700,000
Components & Installation	LS	---	---	175,000
Demolition	LS	---	---	25,000
Total				$5,000,000

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan Figure 2 - Site Plan (LC-39 Pad A)
Figure 3 - Site Plan (LC-39 Pad B)

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
MODERNIZE FIREX SYSTEM, PADS A AND B

LOCATION PLAN
JOHN F. KENNEDY SPACE CENTER, FLORIDA

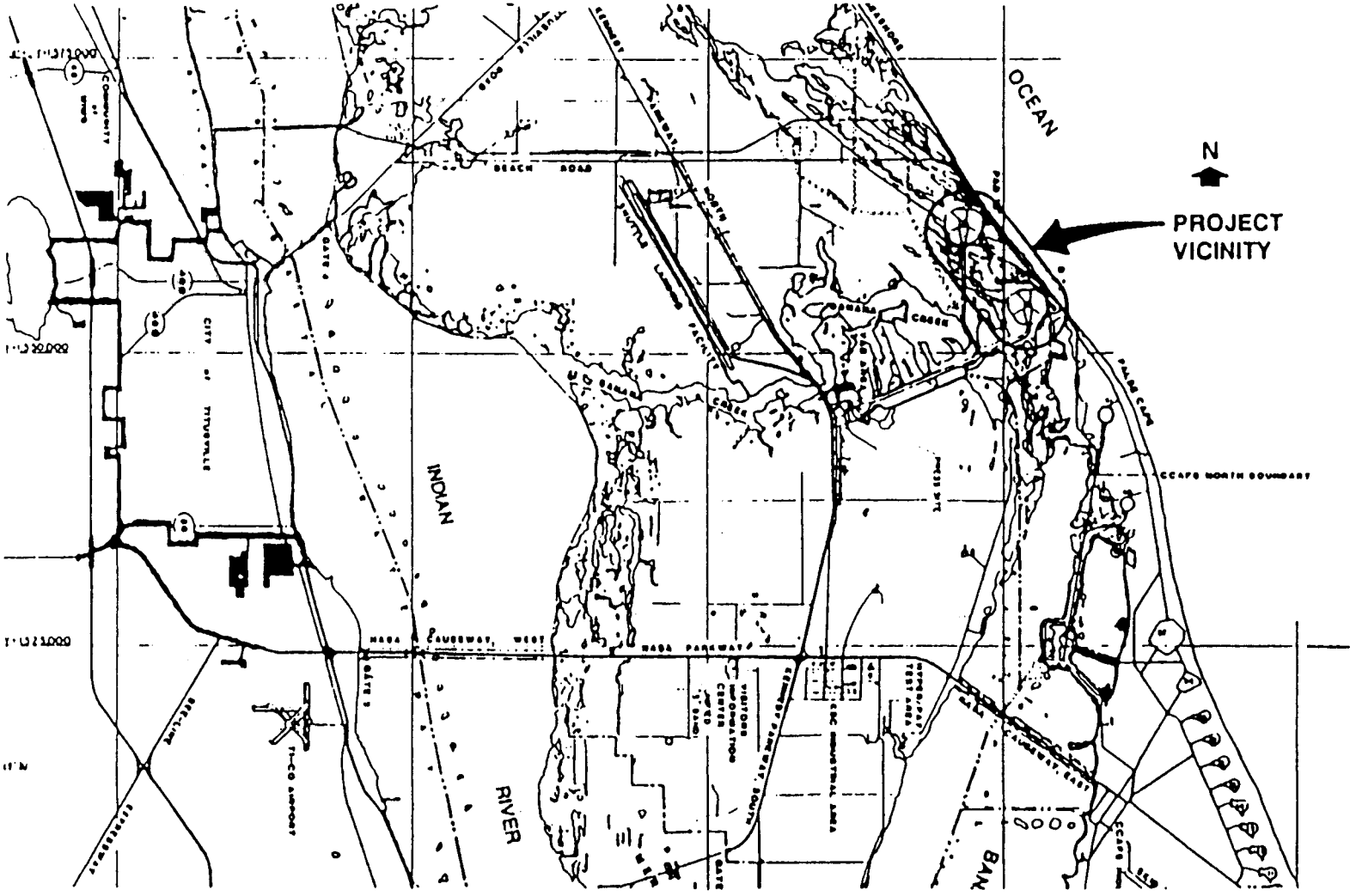


FIGURE 1

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
MODERNIZE FIREX SYSTEM, PADS A AND B

SITE PLAN
LC-39 PAD A

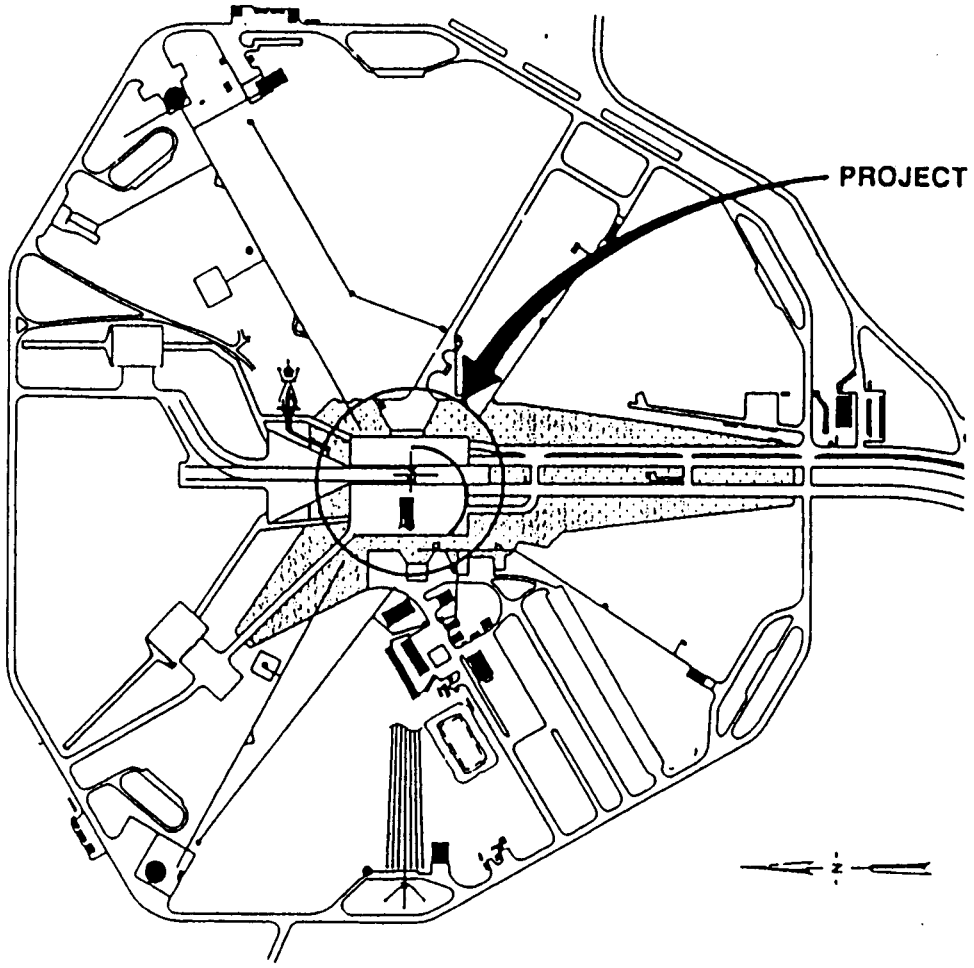


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
MODERNIZE FIREX SYSTEM, PADS A AND B

SITE PLAN
LC-39 PAD B

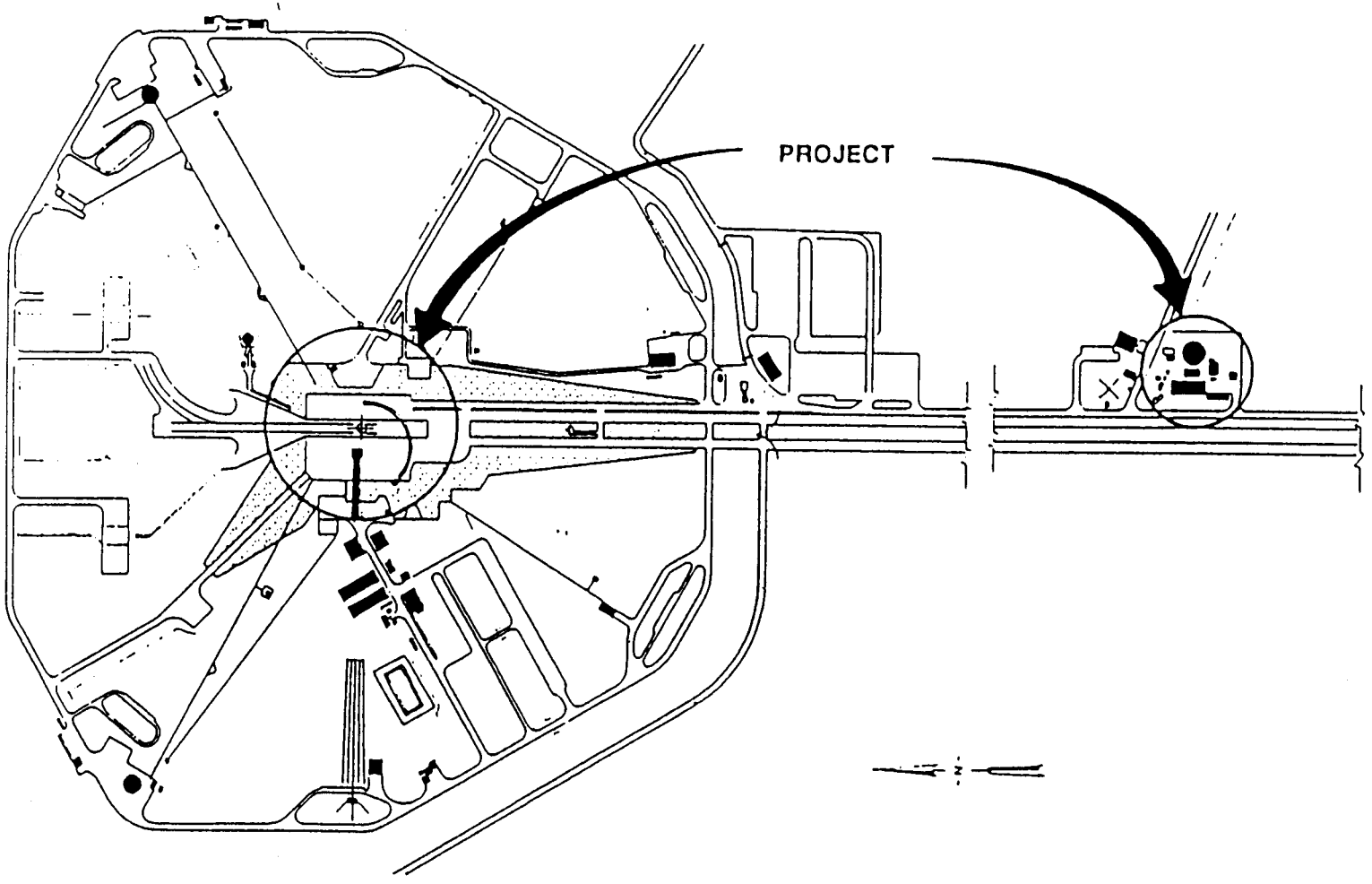


FIGURE 3

Science, Aeronautics
and Technology

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1996 ESTIMATES

SUMMARY

SCIENCE, AERONAUTICS, AND TECHNOLOGY

	Amount	Page No.
	(Dollars)	
Science:		
Construction of Earth Systems Science Building, Goddard Space Flight Center	17,000,000	CF 2-1
Construction of Addition to Microgravity Development Laboratory, Marshall Space Flight Center	3,000,000	CF 2-5
Aeronautics:		
Modernization of the Unitary Plan Wind Tunnel Complex, Ames Research Center	5,400,000	CM 2-9
Total Science, Aeronautics, and Technology	25,400,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Construction of Earth Systems Science Building

INSTALLATION: Goddard Space Flight Center

FY 1996 Estimate: $17,000,000

LOCATION OF PROJECT: Greenbelt, Prince George's County, Maryland

COGNIZANT HEADQUARTERS OFFICE: Office of Mission to Planet Earth

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$4,554,050	$29,000,000	$33,554,050
Capitalized Investment	---	---	---
Total	$4,554,850	$29,000,000	$33,554,850

SUMMARY PURPOSE AND SCOPE:

This project provides the third and final increment of the Earth Systems Science Building (ESSB) at the Goddard Space Flight Center (GSFC). The facility will provide approximately 290,000 square feet to house civil service, contractor, and visiting scientist personnel conducting interdisciplinary Earth science and research into global change. This facility is located adjacent to the Earth Observing System Data Information System (EOSDIS) Facility and will support the Earth Observing System (EOS) program by data analysis, assimilation, and instrument and algorithm development.

PROJECT JUSTIFICATION:

The United States has taken the leadership role in one of the largest Earth Science enterprises--Global Change research. The Earth Observing Systems (EOS) Program is a critical component of this effort. It will contribute principal Earth observing, data processing and archiving, and Earth systems scientific research capabilities essential to conduct this research. Goddard Space flight Center is NASA's lead Center for EOS, with responsibility for development of Earth Observing capabilities including the Earth Observing System Morning Crossing (EOSAM) and Earth Observing System Afternoon Crossing (EOSPM) spacecraft; GSFC-sponsored NASA facilities class instruments; Earth Science mission operations; principal or co-investigators for a number of EOS-related scientific investigations; Land Remote-Sensing Satellite (LANDSAT); and processing, archiving, and disseminating GSFC-related EOS data.

The Earth System Science Building (ESSB) brings together vital elements of GSFC's substantial Earth Sciences talent in facilities dedicated to the conduct of EOS/Global Change research. This is essential to facilitate and promote the interdisciplinary scientific research required to achieve EOS/Global Change research goals. The ESSB will also provide a venue for collaboration between NASA and other scientists engaged in Global Change research. The proximity of the ESSB Facility to the EOSDIS Facility will provide ready access to the GSFC EOS Distributed Active Archive Center (DAAC), the central repository (located within the EOSDIS Facility) for all GSFC EOS-related data.

IMPACT OF DELAY:

If the ESSB facility is delayed, it will adversely impact the analysis and understanding of EOS data, as well as delay the development of instrumentation and algorithms for future Earth Science missions.

PROJECT:

The 290,000 square foot facility is located on the east site adjacent to the EOSDIS Facility at Greenbelt and Soil Conservation Service Roads. The first increment (FY 1994) provided for site development/utilities, and included extension of basic utilities infrastructure to the ESSB site, expansion of EOSDIS utility plant including provision for backup diesel electric power, and construction of ESSB footings and foundations. The second increment (FY 1995) will provide the ESSB shell and procurement of building architectural, mechanical and electrical long lead items. This third and final increment will provide for installation of the architectural, mechanical,

and electrical long lead items; construction of building interior, partitioning, and finishes; and completion of the facility.

PROJECT COST ESTIMATE:	Unit of Measure	Quantity	Unit Cost	Cost
Construction:	---	---	---	$17,000,000
Architectural	LS	---	---	10,200,000
Mechanical	LS	---	---	2,800,000
Electrical	LS	---	---	4,000,000
Total..				$17,000,000

Note: The total cost of the project is estimated to be $46 million. In FY 1994, $12M was provided and in FY 1995, $17M was provided.

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

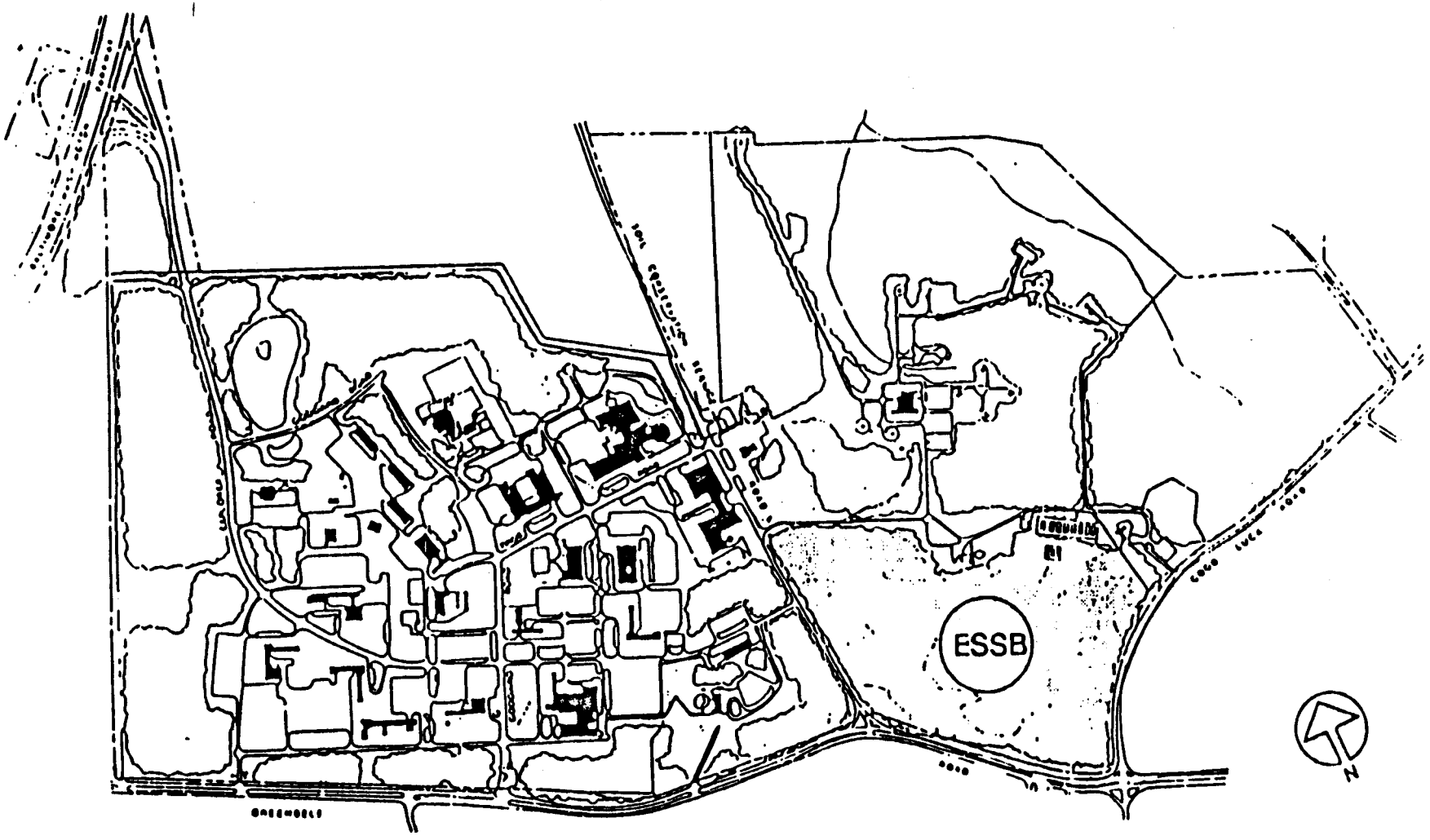
OTHER EQUIPMENT SUMMARY:

Noncollateral equipment such as systems furniture, other furnishings, and equipment for special purpose areas will be required at a cost of approximately $20,000,000, which will be provided from other program resources.

FUTURE ESTIMATED CONSTRUCTION FUNDING RSOUIRED TO COMPLETE THIS PROJECT: None

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1996 ESTIMATES
CONSTRUCTION OF EARTH SYSTEMS SCIENCE BUILDING (ESSB)

LOCATION PLAN



CF 2-4

FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Construction of Addition to Microgravity Development Laboratory

INSTALLATION: George C. Marshall Space Flight Center

FY 1996 Estimate: $3,000,000

LOCATION OF PROJECT: Marshall Space Flight Center, Madison County, Alabama

COGNIZANT HEADQUARTERS OFFICE: Office of Life and Microgravity Sciences and Applications

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$240,000	---	$240,000
Capitalized Investment	---	$541,040	541,040
Total	$240,000	$541,040	$781,040

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a 1,600 square meter addition to the Microgravity Development Laboratory, Building 4493. The addition will house ground control experiment laboratories (GCEL) and clean rooms for the development of flight hardware. The space provided will also be used for the processing of microgravity experiment flight hardware before and after scheduled flights. The existing structure is not large enough to accommodate these efforts.

PROJECT JUSTIFICATION:

The Microgravity Experiments Project Office is establishing a Microgravity Development Laboratory facility in which to conduct microgravity science and applications research. This project will increase the capabilities for the facility to support microgravity experiment development, processing of flight hardware, and in-flight operations. The facility will include GCEL, hardware clean rooms, a Microgravity User Operations Facility, and a Microgravity Data Center and Archive. Building **4493** has been selected to house these activities, however, it is too small to operate them all. The proposed addition will provide space for the GCEL, and for clean room, laboratory, and office activities. The remaining activities will be housed in the existing portion of the building. These activities are currently being conducted at inadequate and remote locations at MSFC or at off-site contractor locations. This marginal support creates an unnecessary risk to the cost, schedule, and quality of scientific development that can be avoided by constructing this addition. There is no contiguous space at MSFC suitable for the entire activity. Restoration and outfitting, with unavoidable duplication of equipment, of the three to four locations required creates a need for supplemental work force and would require frequent movements of flight hardware between the locations. In addition internal development time frames would be increased along with greater risk of damaging the hardware during the moves.

IMPACT OF DELAY:

Deferring this project will adversely impact the development of microgravity experiments available for currently manifested Shuttle flights as planned for the space station. By not constructing the facility as planned, the required timeliness and quality of supporting research can not be attained at the lowest cost and the underlying science infrastructure will be degraded.

PROJECT:

The project provides for the construction of an approximately 1,600 square meter addition to the west end of Building **4493.** Office areas, conference rooms, corridors, laboratories, and work areas requiring no special construction will have painted gypsum board walls and mineral board suspended acoustic ceilings. Certain laboratory areas will require a variety of special features ranging from raised computer flooring to prefabricated clean room components. Clean rooms will generally be constructed using wall panels consisting of porcelain enamel bonded to a rigid backing material. The project provides for the installation of light-duty cranes; high purity air and high pressure gas services; electrical power and data distribution systems; and heating,

ventilation, and air conditioning (HVAC) systems. High bay space with 6 meter clear height will be provided along with support areas such as airlocks, storage space, and dressing rooms. An office area will be provided to support science investigators.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$3,000,000
Site	LS	---	---	100,000
Civil	LS	---	---	720,000
Architectural/Structural . . .	LS	---	---	460,000
Mechanical	LS	---	---	1,020,000
Electrical	LS	---	---	700,000
Total..				$3,000,000

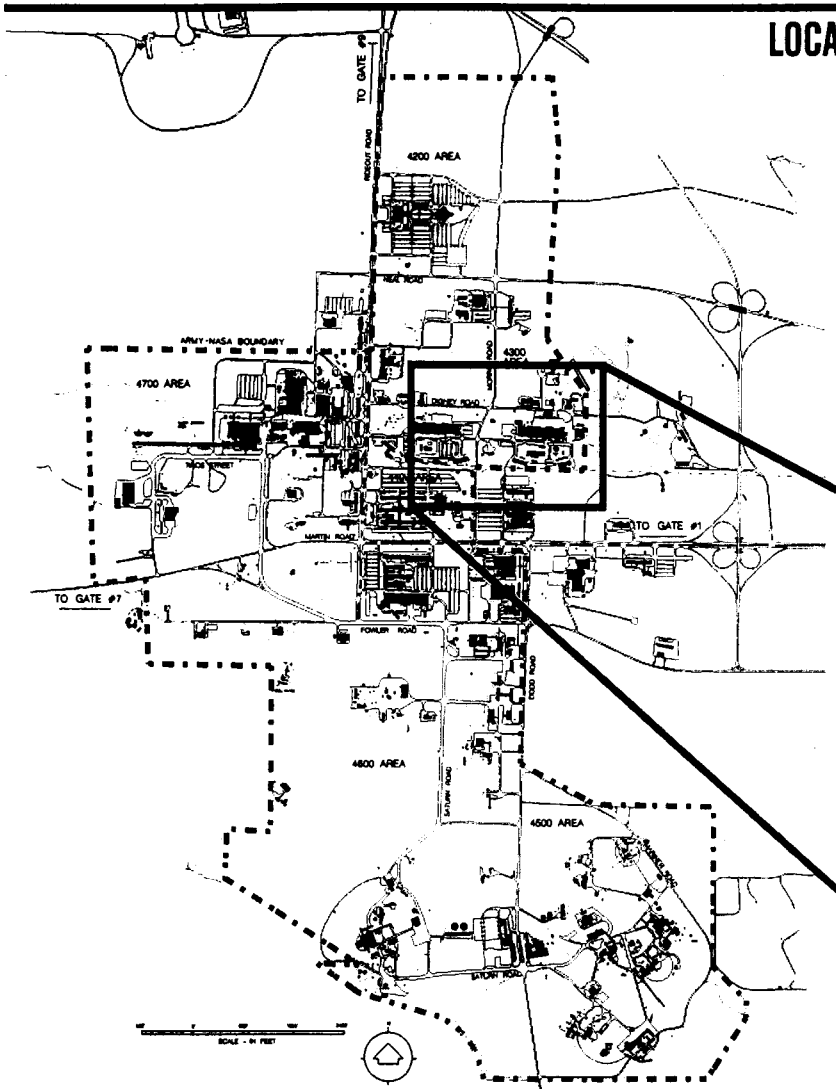
LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY: $500,000 of support equipment will be provided from other program resources.

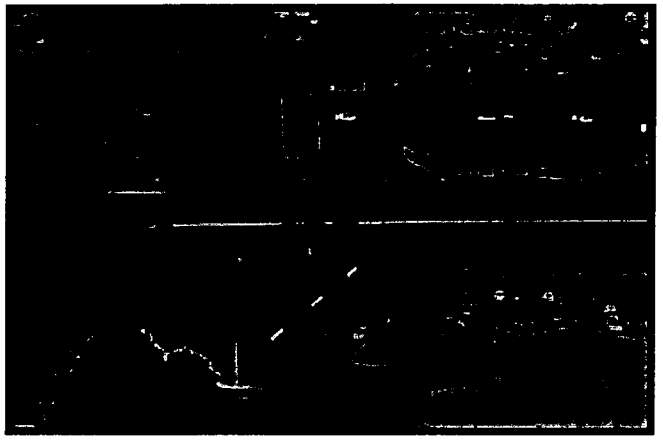
FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1996 ESTIMATES
CONSTRUCTION OF ADDITION TO MICROGRAVITY DEVELOPMENT LABORATORY

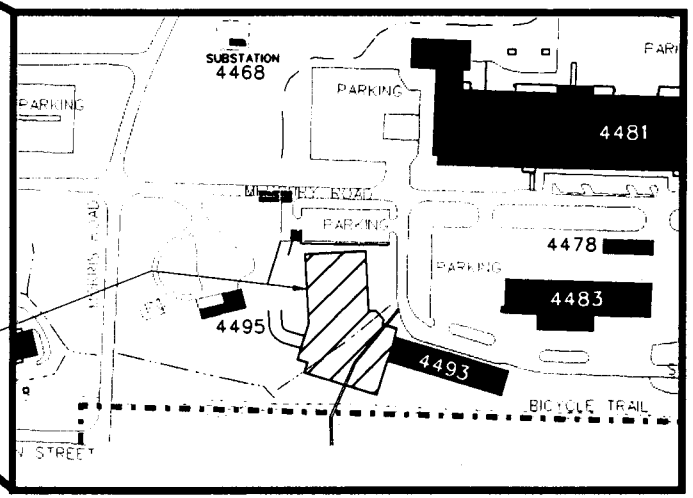
LOCATION PLAN



MARSHALL SPACE FLIGHT CENTER
NOT TO SCALE



VIEW FROM EAST



ENLARGED SITE PLAN
NOT TO SCALE

FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Modernization of the Unitary Plan Wind Tunnel Complex

INSTALLATION: Ames Research Center

FY 1996 Estimate: $5,400,000

LOCATION OF PROJECT: Moffett Field, Santa Clara County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$4,600,000	$ 55,000,000	$ 59,600,000
Capitalized Investment	---	51,401,574	51,401,574
Total	$4,600,000	$106,401,574	$111,001,574

SUMMARY PURPOSE AND SCOPE:

This project provides funding for modernization of the Unitary Plan Wind Tunnel Complex to improve productivity, reliability, and the quality of test results. The project will provide new automated tunnel and model support controls; automated controls for tunnel auxiliaries; flow quality improvements in the 11 by 11 foot Transonic Wind Tunnel (11-ft TWT); repair or replacement of aging facility systems; and repair of weld defects in the pressure shell to allow recertification.

PROJECT JUSTIFICATION:

The Unitary Plan Wind Tunnel (UPWT) is a vital National high-speed tunnel facility consisting of one transonic and two supersonic test sections and supporting auxiliary equipment. This facility is the most heavily used wind tunnel complex in NASA. However, the facility's productivity is limited by the 1950's era control systems and the increasing frequency of equipment breakdowns due to age and heavy use. Modernization is needed now to improve productivity, data quality, and reliability. This complex has been operated on three-shifts-per-day basis since 1956, with minimal improvements. Tunnel downtime resulting from equipment and control failures has caused major delays to important aircraft projects. Tunnel backlog of testing exceeds two years. Lack of modern data acquisition equipment results in over half of tunnel tests being concluded before all needed data is acquired. Comparable foreign facilities have shown two to three times the productivity achieved in this wind tunnel complex.

Since it was placed in service in 1956, the UPWT Complex has contributed to the development of almost every U.S. developed military and civil aircraft flying or nearing service in its speed regime of Mach 0.3 to 3.5, as well as every U.S. manned spacecraft. It has provided valuable experimental results for development of military aircraft such as F-100, F-106, F-111, F-14, F-15, F-16, F-18, F-22, B-58, B-70, B-1, A7, and EA-6; and for commercial transports, including McDonnell Douglas DC-8, 9, 10, 11, 87V/88V, and 90, as well as Boeing 727, 747, 757, 767, and 777.

Repair or replacement of tunnel components that have reached the end of their useful life is required. Also, the welds in the tunnel shell contain defects typical of 1950's technology and must be repaired and the pressure shell recertified.

IMPACT OF DELAY:

Failure to modernize this facility will increase the delay in acquiring critical test data. The existing (unmodified) facility will continue to fail more frequently, requiring the use of alternate testing resources in Europe and other countries. This in turn, will reduce or delay improvements to U.S. commercial and military aircraft, and will significantly increase the cost of testing. In addition, NASA's leadership role in aeronautical research and development will diminish resulting in further degradation of the United States' world leadership in aviation.

PROJECT:

This increment of work will complete controls modernization, automation, and replacement; flow quality improvements and pressure vessel shell repair. The total project includes refurbishing and providing automated controls for the tunnel systems, model support systems, make-up air system, and compressor lubrication system; enlarging and modernizing the control rooms; and installing flow quality improvements in the 11-ft TWT. The project also includes refurbishing, repairing, or replacing major components, including the cooling tower, large electrical switchgear, and make-up air system; and repairing weld defects in the pressurized portions of the tunnel circuits and make-up air system and recertifying the pressurized systems for safe operation.

PROJECT COST ESTIMATE	Unit of Measure	Quantity	Unit Cost	Cost
Construction:	---	---	---	$5.400.000
Flow Quality Improvements	LS	---	---	1,100,000
Refurbish and Replace Tunnel Control System	LS	---	---	3,140,000
Repair of Pressure Vessels	LS	---	---	320,000
Construction Management	LS	---	---	340,000
Integration	LS	---	---	500,000
Total				$5,400,000

Note: This cost estimate provides for the FY 1996 increment of the project. The total cost of the project is estimated to be $60.4 million. Previous funding has been provided as follows: FY 1993 - $8.0M, FY 1994 - $25.0M, and FY 1995 - 22.OM.

LIST OF RELATED GRAPHICS: Figure 1 - Site Plan Figure 2 - Perspective

OTHER EQUIPMENT SUMMARY: Data acquisition systems, model check-out equipment, and advanced instrumentation estimated to cost $5 million will be located in this facility.

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

AMES RESEARCH CENTER
FISCAL YEAR 1996 ESTIMATES
MODERNIZATION OF THE UNITARY PLAN WIND TUNNEL COMPLEX

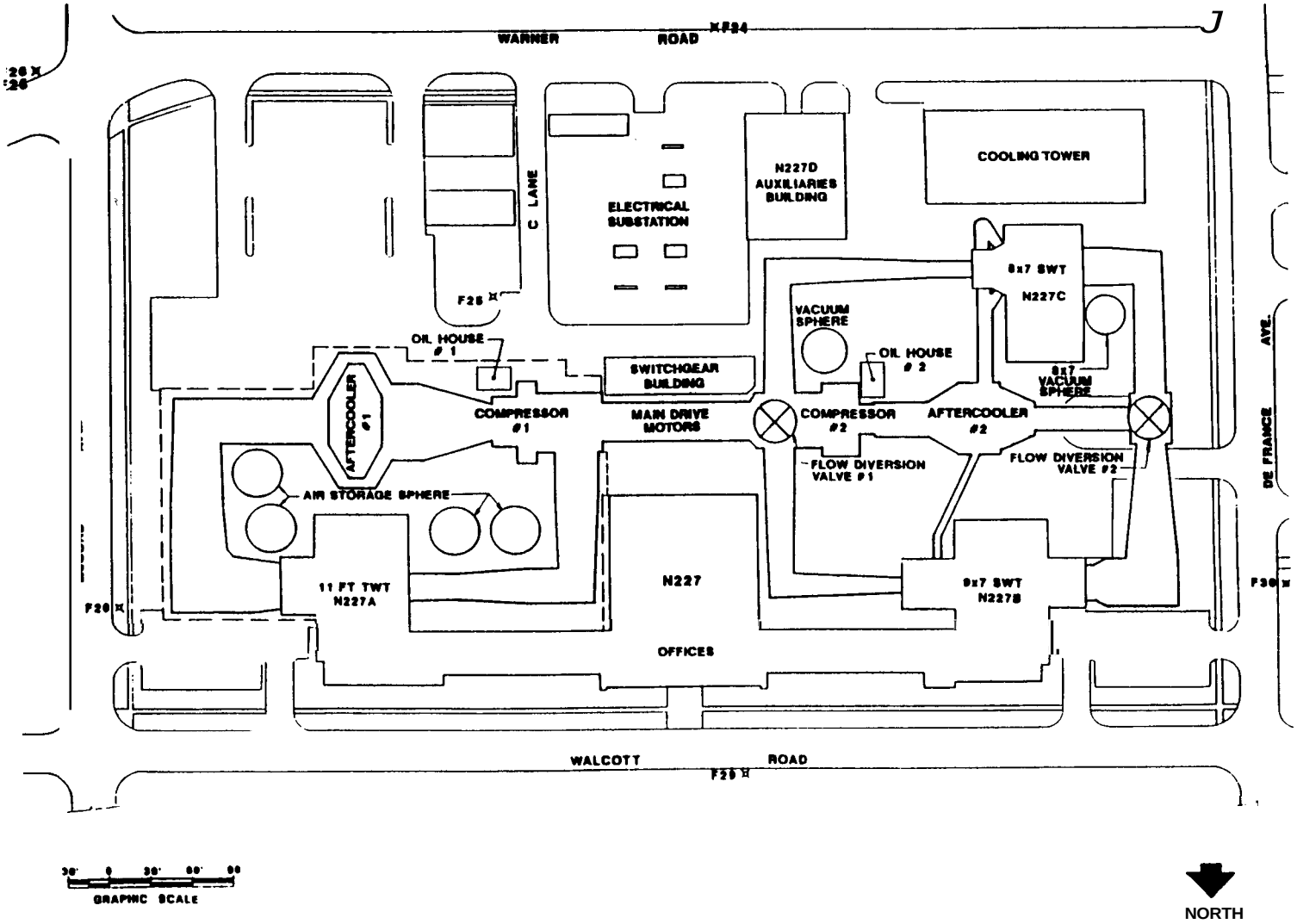


FIGURE 1
SITE PLAN

AMES RESEARCH CENTER
FISCAL YEAR 1996 ESTIMATES
MODERNIZATION OF THE UNITARY PLAN WIND TUNNEL COMPLEX

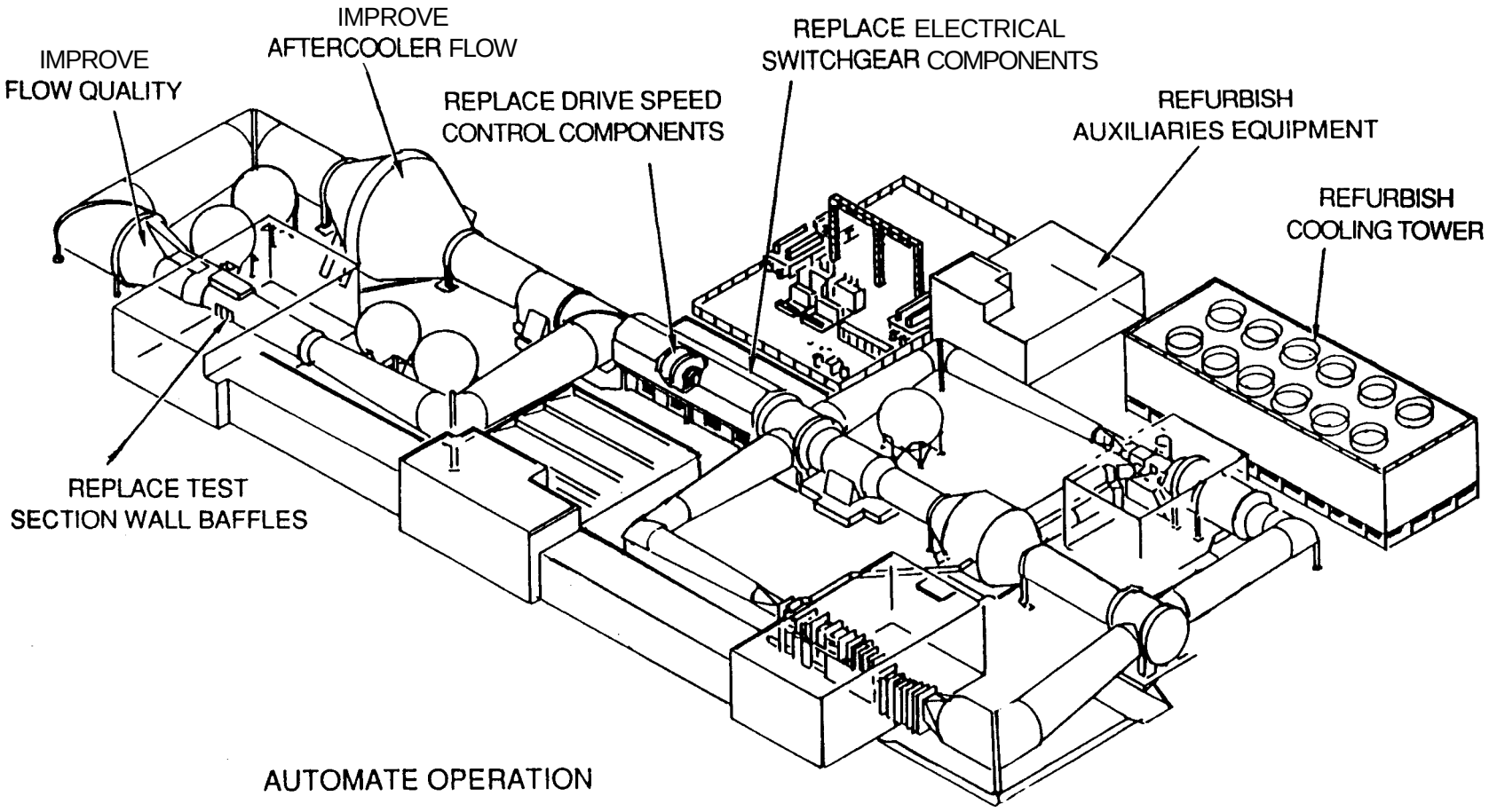


FIGURE 2
PERSPECTIVE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1996 ESTIMATES

SUMMARY

MISSION SUPPORT

	Amount	Page No.
	(Dollars)	
Restoration of Flight Systems Research Laboratory, Ames Research Center	6,300,000	CF 3.1-1
Restoration of Chilled Water Distribution System, Goddard Space Flight Center	3,000,000	CF 3.1-7
Replace Chillers, Various Buildings, Jet Propulsion Laboratory	4,800,000	CF 3.1-10
Rehabilitation of Electrical Distribution System, White Sands Test Facility, Johnson Space Center	1,100,000	CF 3.1-13
Replace Main Substation Switchgear and Circuit Breakers, Johnson Space Center	4,200,000	CF 3.1-16
Replace 15kV Load Break Switches, Kennedy Space Center	1,800,000	CF 3.1-19
Rehabilitation of Central Air Equipment Building, Lewis Research Center	9,000,000	CF 3.1-22
Restoration of High Pressure Air Compressor System, Marshall Space Flight Center	4,700,000	CF 3.1-25
Restoration of Information and Electronic Systems Laboratory, Marshall Space Flight Center	6,800,000	CF 3.1-28
Restoration of Canal Lock, Stennis Space Center	1,400,000	CF 3.1-31
Restoration of Primary Electrical Distribution System, Wallops Flight Facility	2,500,000	CF 3.1-34
Repair	35,000,000	CF 3.2
Rehabilitation and Modification	35,000,000	CF 3.3
Minor Construction	3,800,000	CF 3.4
Facility Planning and Design	10,000,000	CF 3.5
Environmental Compliance and Restoration	37,000,000	CF 3.6
Total Mission Support	166,400,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Restoration of Flight Systems Research Laboratory

INSTALLATION: Ames Research Center

FY 1996 Estimate: $6,300,000

LOCATION OF PROJECT: Moffett Field, Santa Clara County, CA

COGNIZANT HEADOUARTERS OFFICE: Office of Aeronautics

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$512,000	---	$ 512,000
Capitalized Investment	---	$6,653,934	6,653,934
Total	$512,000	$6,653,934	$7,165,934

SUMMARY PURPOSE AND SCOPE:

This project will provide the restoration of the Flight Systems Research Laboratory, Building 210, to support important national research programs. Work includes restoration of the HVAC and electrical power systems, structural reinforcement to meet seismic code requirements, removal of, hazardous materials, and restoration of the building's exterior surfaces. Also included is the rehabilitation of existing office, lab, shop, and service space on two floors and construction of additional lab space within the interior of the building.

PROJECT JUSTIFICATION:

Building N-210 provides computer, office, and simulation lab space for important national research programs for NASA, the Army, Air Force, and the Federal Aviation Administration (FAA). These include the joint NASA/FAA program to upgrade the nation's Air Traffic Control (ATC) System and the joint Army/NASA RASCAL research helicopter project. Additional laboratory space is needed for these expanding programs. Restoration is critically needed to improve facilities and work environment required for these important programs, and to assure the safety, reliability, and performance of the electrical power, HVAC, and fire safety systems. Presently, the facility uses excessive energy due to old HVAC equipment, poor windows, and inefficient energy control systems. Building N-210 is the oldest structure at Ames Research Center, and numerous modifications over many years have fragmented the infrastructure, resulting in code violations and high maintenance costs. Electrical transformers contain hazardous PCB materials. Handicap access to the facility and existing restrooms do not meet code requirements. Building corridors do not provide proper egress from the building, violating fire codes.

IMPACT OF DELAY:

Delaying this project risks injury to personnel during a seismic event or fire and continues the liability of using a facility with safety code violations. Expanding programs will lead to additional crowding of personnel and equipment. The failure of a PCB transformer would force vacating the building until a lengthy and expensive cleanup operation could be completed.

PROJECT:

The work will include the replacement of the existing building HVAC and electrical power distribution systems, restoration of the existing deteriorating exterior surfaces of the building, removal of hazardous asbestos and PCB materials in all areas, and provisions for handicapped access. Seismic improvements will include new concrete shear walls within the building and installation of steel cord ties at designated floor diaphragms.

Two new 565 kW chillers will be added. An ice bank stored cooling system will be used to provide redundant cooling capacity. A two cell, low profile induced draft cooling tower and building air handlers will be added. A new boiler will be installed. All system controls will be connected to the Ames Facilities Management and Control System.

Office, computer lab, shop, and service areas on two floors of the building will be rehabilitated. The interior of the building will be reconfigured to allow for an additional 650 square meters of usable space. Fire and safety systems will be restored with installation of new smoke detectors. The existing automatic wet pipe sprinkler system will be expanded to all areas of the building. Existing electrical switchgear and panels served by transformers T-75 and T-76 will be replaced.

PROJECT COST ESTIMATE	Unit of Measure	Quantity	Unit Cost	Cost
Construction:	---	---	---	$6,300,000
Architectural	LS	---	---	2,000,000
Structural	LS	---	---	300,000
Electrical & Communications	LS	---	---	700,000
Mechanical & Plumbing	LS	---	---	2,300,000
Safety, Fire Protection & Security	LS	---	---	400,000
Hazardous Materials Removal	LS	---	---	600,000
Total				$6,300,000

LIST OF RELATED GRAPHICS: Figure 1 - Site Plan
Figure 2 - First Floor Plan
Figure 3 - Second Floor Plan

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

AMES RESEARCH CENTER
FISCAL YEAR 1996 ESTIMATES
RESTORATION OF THE FLIGHT SYSTEMS RESEARCH LABORATORY

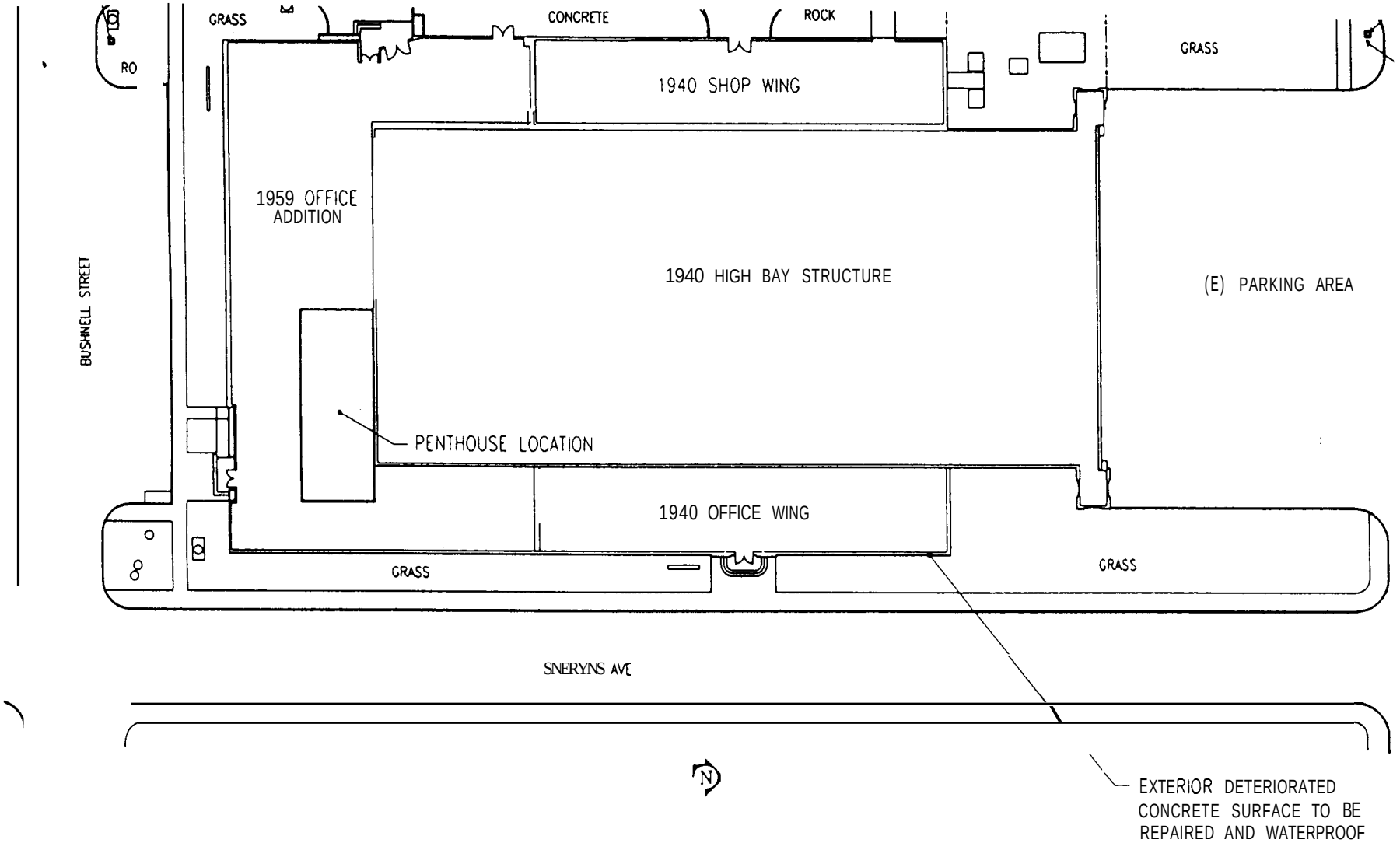


FIGURE 1
SITE PLAN

CF 3.1-4

AMES RESEARCH CENTER
FISCAL YEAR 1996 ESTIMATES
RESTORATION OF THE FLIGHT SYSTEMS RESEARCH LABORATORY

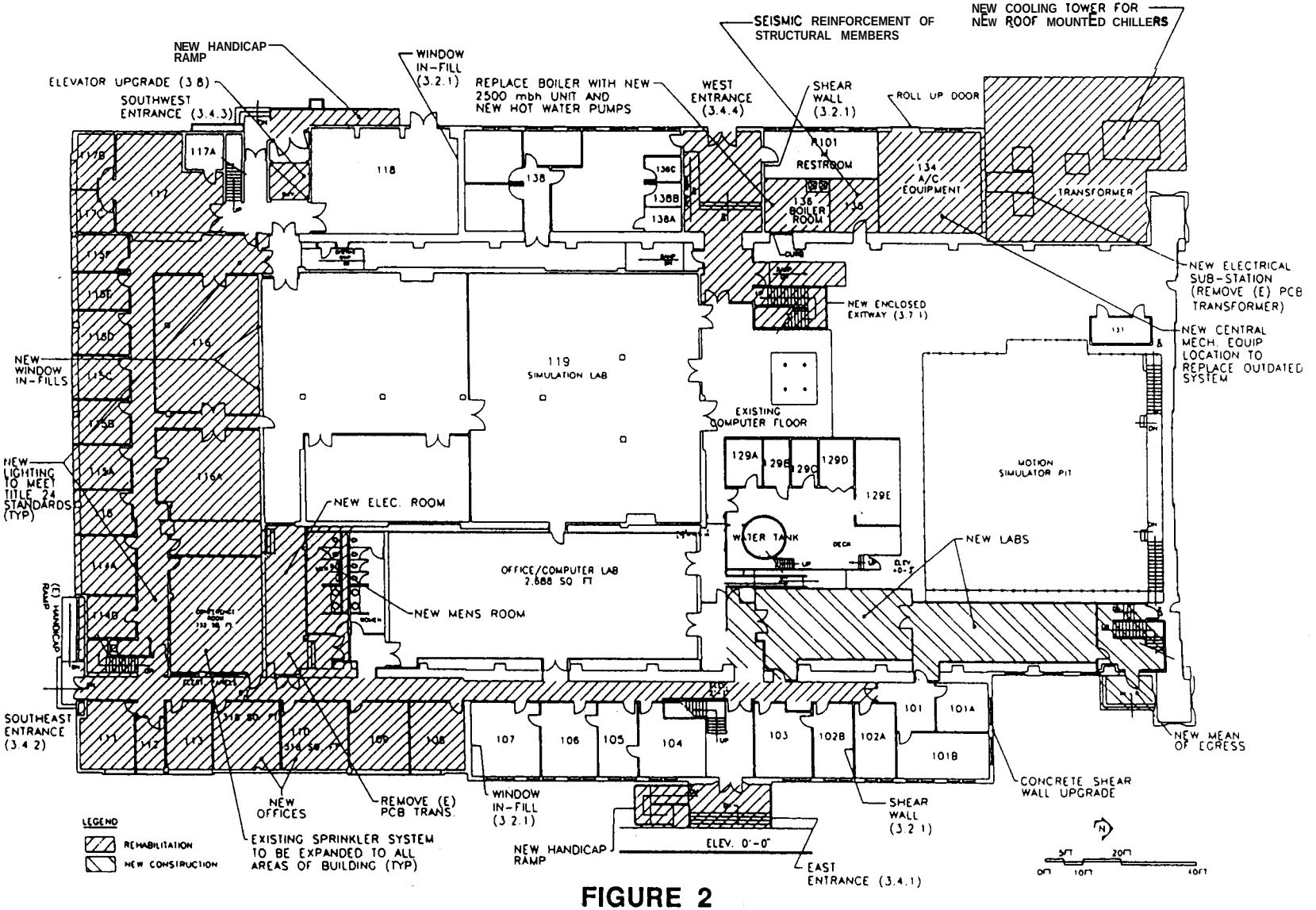


FIGURE 2

FIRST FLOOR PLAN

AMES RESEARCH CENTER
FISCAL YEAR 1996 ESTIMATES
RESTORATION OF THE FLIGHT SYSTEMS RESEARCH LABORATORY

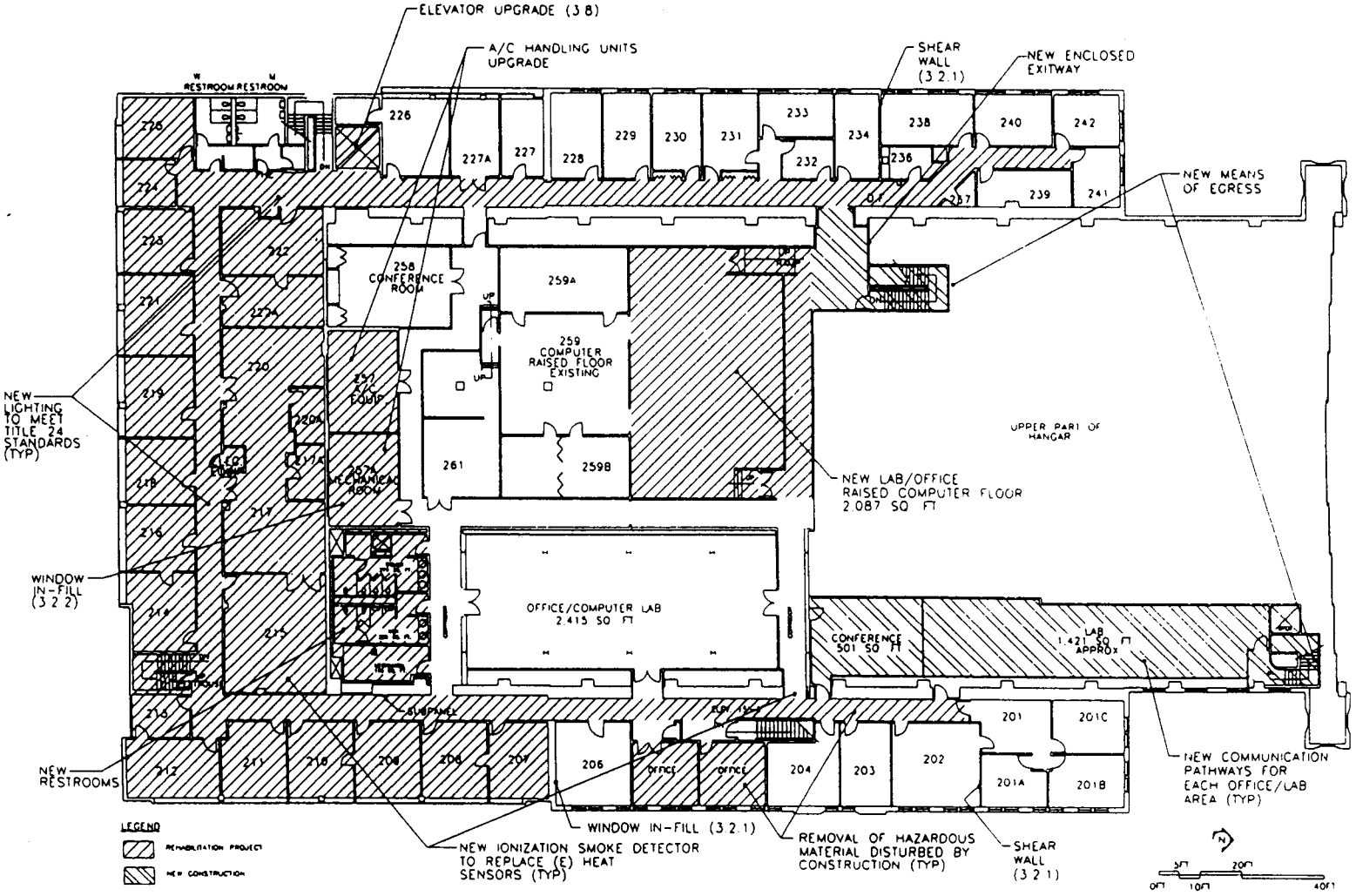


FIGURE 3
SECOND FLOOR PLAN

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Restoration of Chilled Water Distribution System

INSTALLATION: Goddard Space Flight Center

FY 1996 ESTIMATE: $3,000,000

LOCATION OF PROJECT: Greenbelt, Prince George's County, Maryland

COGNIZANT HEADQUARTERS OFFICE: Office of Mission to Planet Earth

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$300,000	---	$ 300,000
Capitalized Investment	---	$3,874,500	3,874,500
Total	$300,000	$3,874,500	$4,174,500

SUMMARY PURPOSE AND SCOPE:

This project provides for the restoration of major segments of the chilled water distribution system at the Goddard Space Flight Center (GSFC). The project will replace underground piping that is aging and undersized, and install shutoff valves.

PROJECT JUSTIFICATION:

GSFC has experienced serious problems with the central chilled water distribution system. The underground chilled water piping is approximately 30 years old and at the end of its expected useful service life. The pipes and valves have deteriorated and are leaking substantially. With

the modernization of the central chilled water plant, the new secondary pumps will boost the pressure by 103 to 138 kPa, which will add even more stress to the system. Pipe sizes in several sections of the system are inadequate for existing as well as future design flow rates. Some critical buildings do not have adequate redundancy in the event of a chilled water service failure. This project will replace piping and upgrade the system. Redundant circuits will also be provided to improve reliability.

IMPACT OF DELAY:

Delay of this project will result in increasing leakage and failures due to aging piping and increasing pressures. Ongoing construction will place additional demands on the chilled water system and some portions of the system will experience flow deficiencies unless pipes sizes are increased. As a result, some buildings will have inadequate chilled water quantities and air conditioning capacity.

PROJECT:

This project provides for the replacement of various segments of the underground chilled water distribution piping in the northeast, northern, and southern portions of the site. In the northeast sector, two 305 mm pipe mains (supply and return lines) will be replaced from an area south of Building 24 to an area near the intersection of Minitrack and Tirus Roads. In the northern and southern sectors, chilled water feed lines to Buildings 1, 2, 14, 18, 19, and 20 will be replaced. The project includes all site work required for excavation, rerouting other utilities, backfill, and resurfacing associated with piping work. Asbestos insulation on existing piping will be removed to the extent that it is necessary to perform the work.

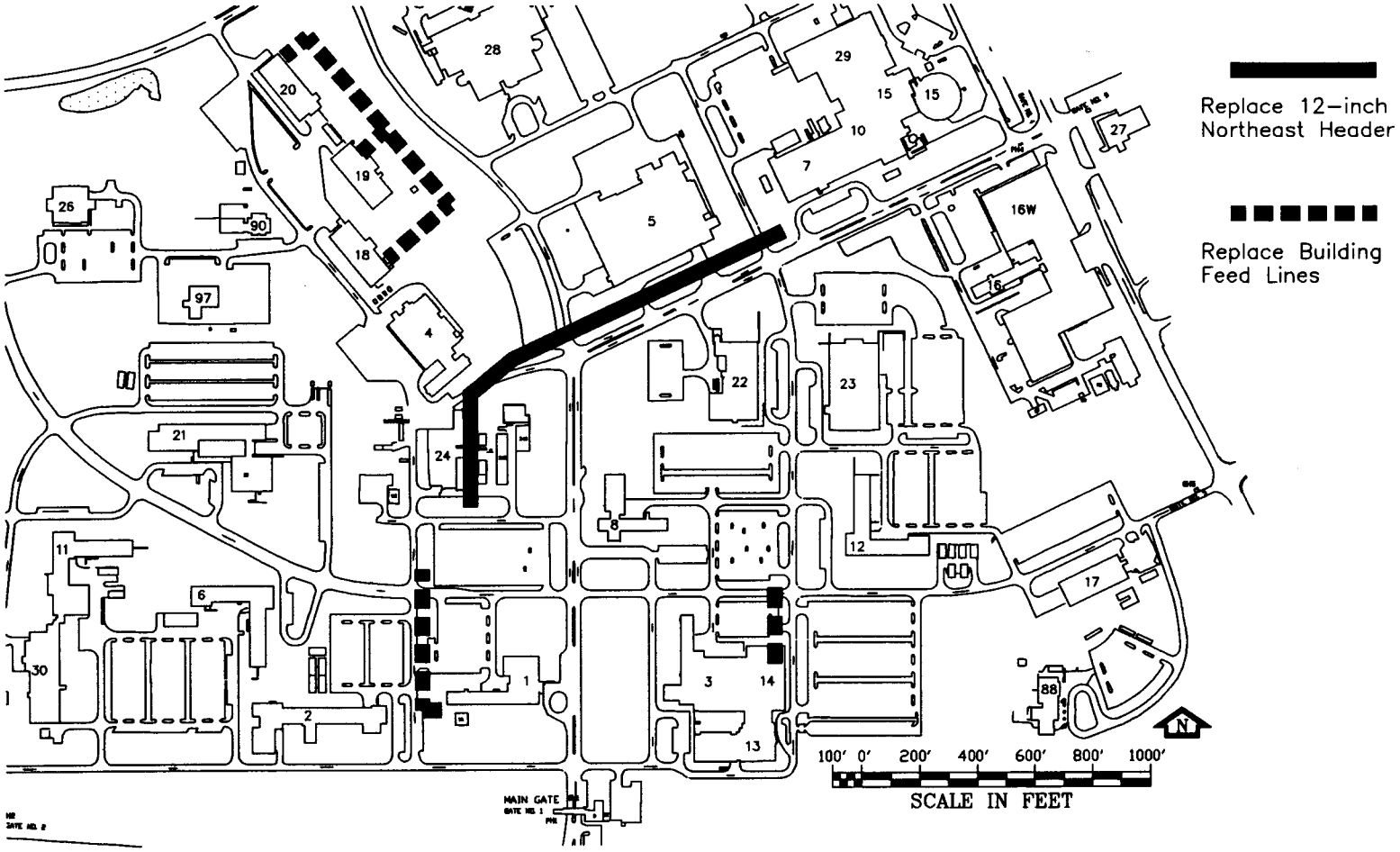
PROJECT COST ESTIMATE:	Unit of Measure	Quantity	Unit Cost	Cost
Construction:	---	---	---	$3,000,000
Northeast Pipe Replacement	LS	---	---	2,200,000
Building Feed Lines	LS	---	---	800,000
Total				$3,000,000-

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

FUTURE ESTIMATED CONSTRUCT10N FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1996 ESTIMATES
RESTORATION OF CHILLED WATER DISTRIBUTION SYSTEM

LOCATION PLAN



CF 3.1-9

Figure 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Replace Chillers, Various Buildings

INSTALLATION: Jet Propulsion Laboratory

FY 1996 Estimate: $4,800,000

LOCATION OF PROJECT: La Canada-Flintridge, Los Angeles County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project.

	Planning and Design	Construction	Total
Specific Construction Funding	$513,852	$ 2,900,000	$ 3,413,852
Capitalized Investment	---	24,874,054	24,874,054
Total.	$513,852	$27,774,054	$28,287,906

SUMMARY PURPOSE AND SCOPE:

The project will replace 12 obsolete, 25 year old chillers with state-of-the-art chillers in Buildings 157, 161, 179, 180, 198 and 233. The replacement units will use new alternative refrigerants which will comply with federal and state environmental regulations. This project will also consolidate the chillers serving Buildings 161, 198, and 156.

PROJECT:

The chillers to be removed are over 25 years old and are beyond their economic and mechanically useful lives. They are unreliable, inefficient and difficult and expensive to maintain. In many instances, repair parts are very hard to find or must be hand made. The refrigerant which these obsolete chillers use is now environmentally unacceptable. The replacement chillers will use environmentally acceptable refrigerants. The obsolete chillers are too old for retrofitting with acceptable refrigerants.

IMPACT OF DELAY:

The Jet Propulsion Laboratory (JPL) will be forced to continue use of obsolete, deteriorated chillers which are costly to maintain and energy inefficient. In addition, JPL will lose the opportunity to eliminate almost 4,500 kilograms of ozone depleting chlorofluorocarbons from routine use.

PROJECT DESCRIPTION:

This project proposes to replace a total of 12 chillers in Buildings 157, 161, 179, 180, 198 and 233. New chillers will be water cooled, hermetic centrifugal type with non-ozone depleting refrigerants. Chiller size in each building will be reevaluated and adjusted to reflect the current or reasonably anticipated air conditioning load in that building or building complex. Similarly, both condensing water and chilled water pumps will be checked and replaced as necessary to meet new chiller characteristics. Chillers presently looped to serve Buildings 156, 161 and 198 will be concentrated in Building 161, retaining the pumps in Building 198.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Cost
Construction:	---	---	---	$4,800,000
Mechanical	LS	---	---	4,740,000
Electrical	LS	---	---	60,000
Total				$4,800,000

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

FUTURE ESTIMATED CONSTRUCTION FUNDING RROUIRED TO COMPLETE THIS PROJECT: None

JET PROPULSION LABORATORY
FISCAL YEAR 1996 ESTIMATES
REPLACE CHILLERS, VARIOUS BUILDINGS

LOCATION PLAN

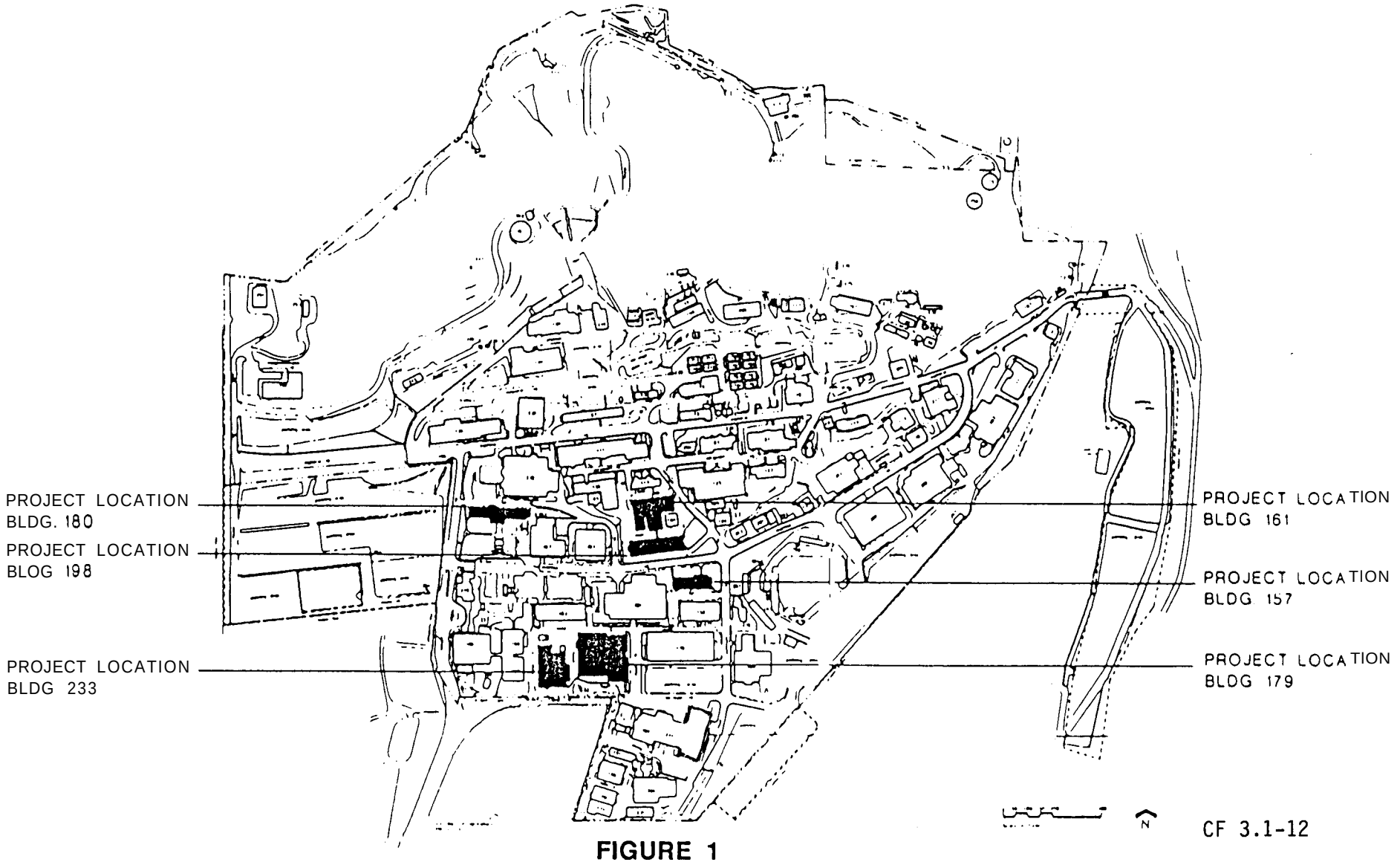


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Rehabilitation of Electrical Distribution System

INSTALLATION: White Sands Test Facility

FY 1996 Estimate: $1,100,000

LOCATION OF PROJECT: Las Cruces, Dona Ana County, New Mexico

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$106,831	---	$106,831
Capitalized Investment	---	$494,155	494,155
Total	$106,831	$494,155	$600,986

SUMMARY PURPOSE AND SCOPE:

This project provides for the rehabilitation of the White Sands Test Facility (WSTF) secondary electrical distribution system in areas 200, 300, 400, and 800.

PROJECT JUSTIFICATION:

The existing electrical system has been in continuous service for over 30 years and experiences numerous failures. Many of the components of the electrical distribution system are obsolete and replacement parts are no longer available. Power conditioning equipment is required to minimize

the influence of power spikes and failures to sensitive equipment that impact test activities and other ongoing activities.

IMPACT OF DELAY:

A delay in the implementation of this project could result in unplanned and prolonged interruptions to test operations; potential damage to sensitive and critical equipment; and continued degradation of hardware, posing personnel safety hazards.

PROJECT:

This project provides for rehabilitation of the WSTF secondary electrical distribution system. The project will include replacement of motor control centers and associated equipment. Power conditioners, state-of-the-art motor controllers, overload devices, and transient voltage surge suppressors will be installed.

PROJECT COST ESTIMATE:	Unit of Measure	Quantity	Unit Cost	Cost
Construction:	---	---	---	$1,100,000
Motor Control Centers	EA	8	129,875	1,039,000
Power Conditioning Devices	EA	2	12,500	25,000
General Equipment and Circuit Upgrade .	EA	1	36,000	36,000
Total				$1,100,000

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: Approximately $1,000,000 will be required to further rehabilitate the secondary electrical distribution systems at WSTF.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
REHABILITATION OF ELECTRICAL DISTRIBUTION SYSTEM
WHITE SANDS TEST FACILITY

LOCATION PLAN

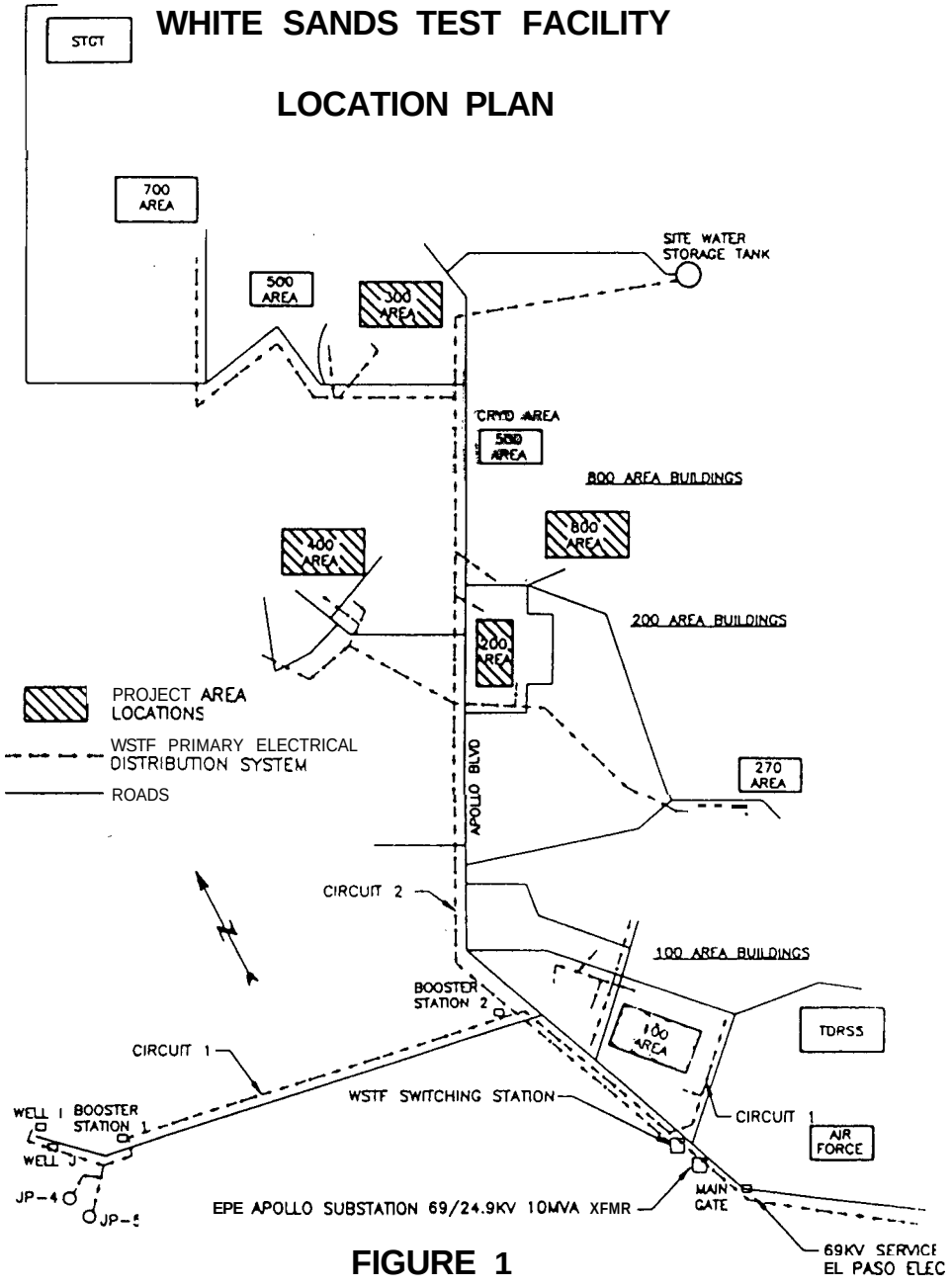


FIGURE 1

CF 3.1-15

Replacement parts for most of this equipment are only available through cannibalization or custom fabrication.

IMPACT OF DELAY:

If this project is not approved, the reliability of the JSC electrical substation and overall site power will continue to deteriorate and increase the probability of equipment damage and ihterruptions to ongoing operations.

PROJECT:

The project includes replacement of 12.5-kV switchgear(bus 2), 12.5-kV switchgear (bus 3), five primary oil circuit breakers, and related interconnecting old bus duct. An upgrade of bus-1 switchgear from 500- to 700-mVA capacity, replacing aluminum conductors in an existing duct bank, and replacing 15-kV switches at Buildings 14, 16A, 36, and 419 will also be accomplished.

PROJECT COST ESTIMATE:	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$4,200,000
Replace Switchgear #2	LS	---	---	1,300,000
Replace Bus Duct	LS	---	---	503,000
Replace Oil Circuit Breakers .	EA	5	10,000	50,000
Block Building Upgrade for Switchgear #2	SM	140	1,070	149,800
Replace 15-kV Switches	EA	4	220,000	880,000
Upgrade Circular Bus to 2000A .	M	245	720	176,400
Replace Conductors	M	18,400	62	**1,140,800**
Total				$4,200,000

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

FUTURE ESTIMATED CONSTRUCTION FUNDING REOUIRED TO COMPLETE THIS PROJECT: None

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
REPLACE MAIN SUBSTATION SWITCHGEAR AND CIRCUIT BREAKERS

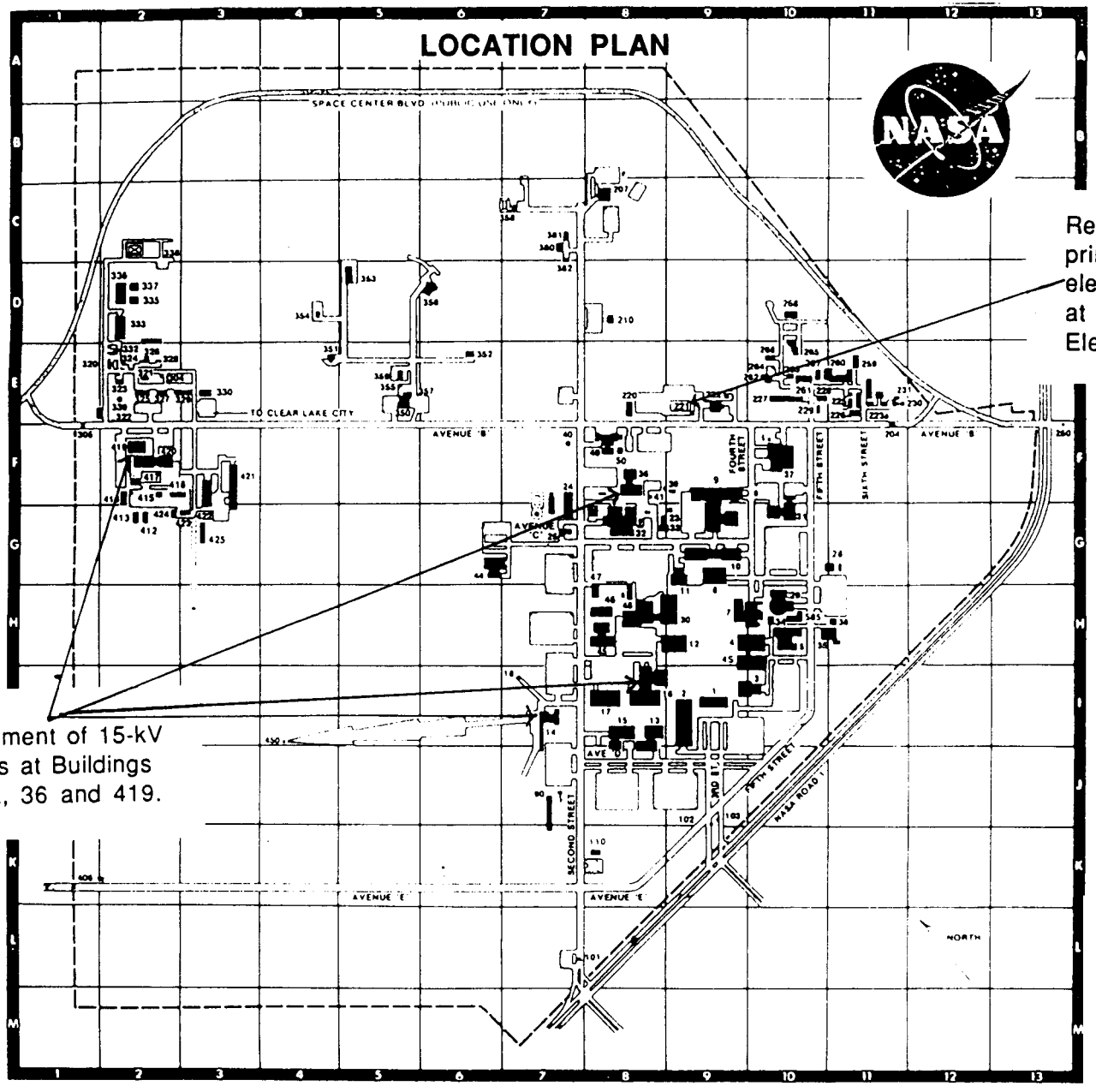


FIGURE 1

CF **3.1-18**

CONSTRUCTION OF FACILITIES

FISCAL YEAR **1996** ESTIMATES

PROJECT TITLE: Replace **15kV** Load Break Switches

INSTALLATION: **John** F. Kennedy Space Center

FY **1996** Estimate: **$1,800,000**

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY **1995** AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	**$254,000**	$ **1,300,000**	$ **1,554,000**
Capitalized Investment	---	**33,244,617**	**33,244,617**
Total	$254,000	$34,544,617	$34,798,617

SUMMARY PURPOSE AND SCOPE;:

This project provides for the refurbishment and service life extension of **15,000** Volt manually operated load break switches to eliminate explosive hazards associated with oil-filled switches.

PROJECT:

The existing manually operated load break switches must be replaced for safety reasons. The obsolete switches have a history of explosive failures which have injured and killed operating personnel. Another reason for replacing the switches is the fact that replacement parts are no longer available from the manufacturer, and the switches cannot be maintained satisfactorily.

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Replace Main Substation Switchgear and Circuit Breakers

INSTALLATION: Lyndon B. Johnson Space Center

FY 1996 Estimate: $4,200,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and De	Construction	Total
Specific Construction Funding	$280,887	---	$ 280,887
Capitalized Investment	---	$2,869,705	2,869,705
Total	$280,887	$2,869,705	$3,150,592

SUMMARY PURPOSE AND SCOPE:

This project provides for replacement of obsolete primary electrical components and subsystems in the Johnson Space Center (JSC) main electrical substation (221) to assure continued, reliable, and safe primary electrical power distribution, and control for the main site operations.

PROJECT JUSTIFICATION:

The circuit breakers, switchgear, and bus duct need to be replaced to eliminate weaknesses in JSC's main substation. The primary switches in buildings 14, 16A, 36, and 419 also need replacement. This equipment is increasingly jeopardizing site power, operators, and equipment.

The new switches incorporate compression spring operations, increase switch range from 400 amps to 600 amps, and use sulfurhexafloride (SF-G) as recommended by NASA safety standards.

IMPACT OF DELAY:

The explosion of a switch containing several gallons of oil presents inevitable risk of fire, injury, and environmental pollution. NASA safety standards and criteria would remain unfulfilled.

PROJECT:

This project will refurbish existing 15,000 Volt load break switches located throughout the center and associated support systems.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$1,800,000
Load Break Switches	LS	---	---	1,555,000
Terminations	LS	---	---	55,000
Splices	LS	---	---	32,000
Pad Mods	LS	---	---	8,000
Miscellaneous Equipment	LS	---	---	150,000
T o t a l				$1,800,000

LIST OF RELATED GRAPHICS: Figure 1 - Illustration of Load Break Switch

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: Future funding required to complete the replacement of all oil-filled switches is approximately $4,000,000.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
REPLACE 15 KV LOAD BREAK SWITCHES

ILLUSTRATION OF LOAD BREAK SWITCH

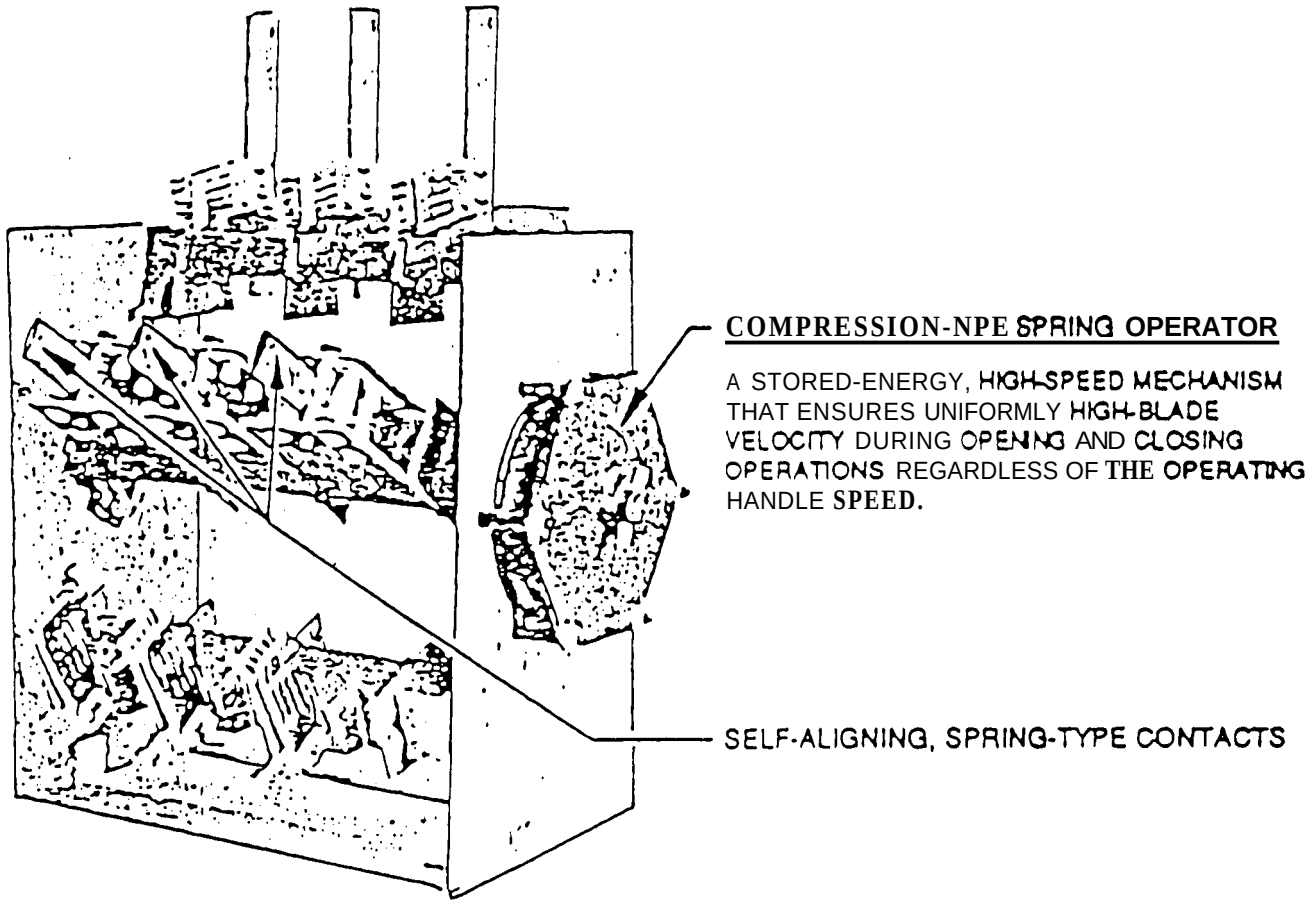


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR **1996** ESTIMATES

PROJECT TITLE: Rehabilitation of Central **Air** Equipment Building

INSTALLATION: **Lewis** Research Center

FY **1996** ESTIMATE: $9,000,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics

FY **1995** AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	**$201,489**	---	$ **201,489**
Capitalized Investment	---	$**28,364,308**	**28,364,308**
Total	$**201,489**	$**28.364,308**	$**28,565,797**

SUMMARY PURPOSE AND SCOPE:

This project provides for the rehabilitation of the Central Air System to assure continued safe and reliable operation of major aeronautical research facilities. The Central Air System equipment has been in continual use for **40** years supporting research in the 10X10 Supersonic Wind Tunnel, 8x6/9x15 Supersonic Wind Tunnel, the Icing Research Tunnel, the Propulsion System Laboratory, Propulsion Lift Facility, and various test cells in the Engine Research Building Complex. The work in this project includes rehabilitation of exhausters and exhauster drive motors.

PROJECT:

This project is required to assure safe, reliable, and continued operation of the Central Air System which is a basic institutional capability that supports: development of propulsion systems for subsonic and supersonic transports, hypersonic vehicles, other advanced systems for commercial and military applications and other various activities. The impellers of the exhauster system were fabricated more than 40 years ago. Over time the impeller vanes have acquired numerous cracks varying in size from 1.5 mm to 50 mm. The cracks can cause catastrophic failure of the system resulting in the possible loss of life and excessive downtime of the system. This project will replace existing rotors, reducing delays in vital LeRC research programs caused by excessive maintenance time. Repair of Exhauster Drive Motors is necessary to assure safe and reliable operation. Periodic observations of these motors indicate that the insulation is deteriorating, which will eventually lead to a major failure.

IMPACT OF DELAY:

Delay of this project will significantly increase the risk of unscheduled and lengthy shutdowns of the Central Air System and also one or more of the other major research facilities at Lewis. The current and planned heavily scheduled propulsion testing is dependent on a high degree of integrity and availability of the Central Air System.

PROJECT:

This project includes replacing deteriorated impellers in exhausters E-41, E-43, E-44, and E-46 located in the Central Air Equipment Building (CAEB) (Bldg. 64). Exhauster inlet guide vanes, bearings, seals, and couplings will also be replaced. Also included is the rewinding and repairing of the exhauster drive motors E-1 and E-43. New grouting will be provided for each motor.

PROJECT COST ESTIMATE	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$9,000,000
Rehabilitate CAEB Exhauster	LS	---	---	7,884,000
Rehabilitate Exhauster Drive Motors	LS	---	---	1,116,000
Total				$9,000,000

LIST OF RELATED GRAPHICS: Figure 1 - Aerial View

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

LEWIS RESEARCH CENTER
FISCAL YEAR 1996 ESTIMATES
REHABILITATION OF CENTRAL AIR EQUIPMENT BUILDING
AERIAL VIEW

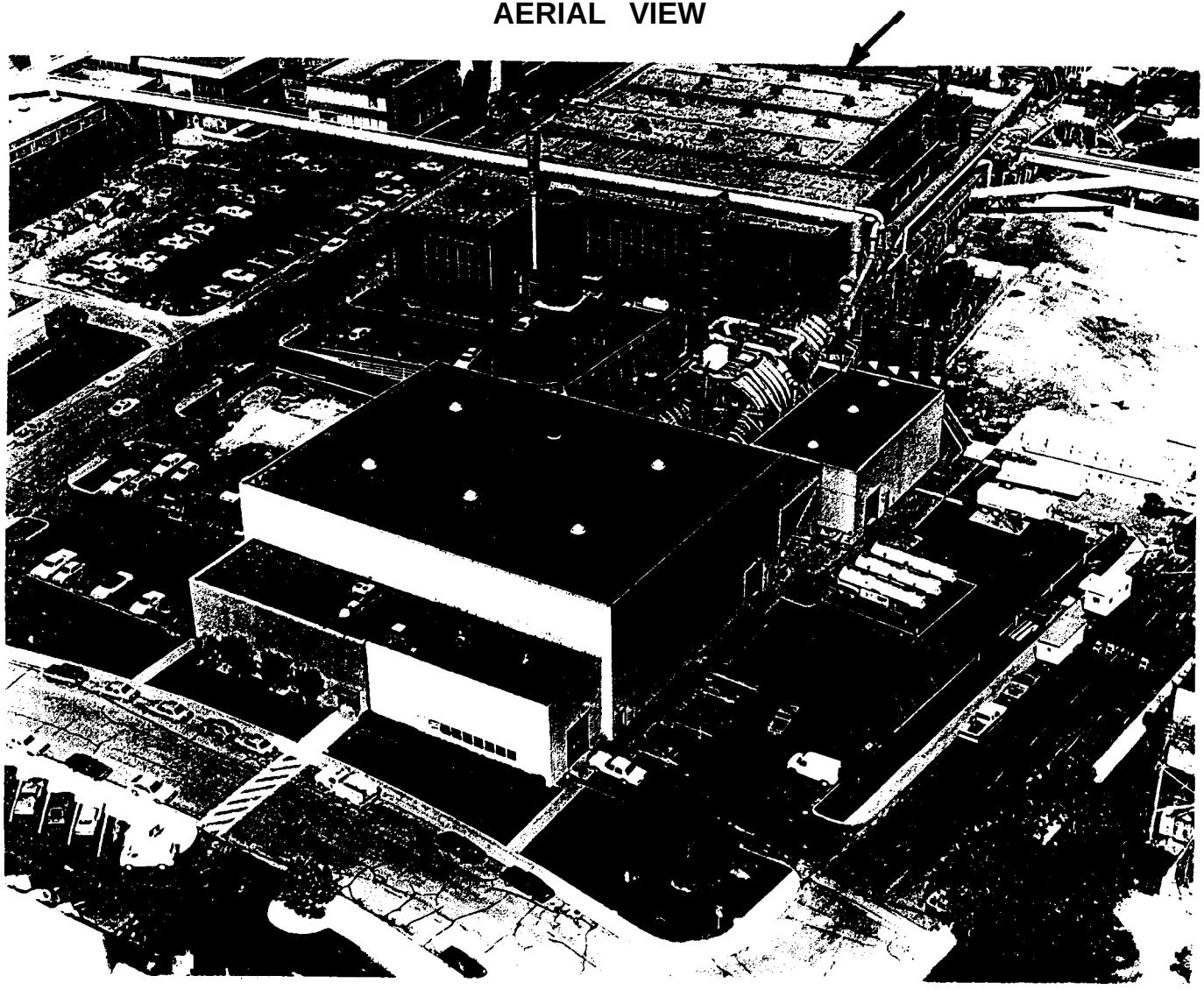


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR **1996** ESTIMATES

PROJECT TITLE: Restoration of High Pressure Air Compressor System

INSTALLATION: George C. Marshall Space Flight Center

FY **1996** Estimate: **$4,700,000**

LOCATION OF PROJECT: Marshall Space Flight Center, Madison County, Alabama

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY **1995** AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	**$784,153**	**$8,500,000**	**$9,284,153**
Capitalized Investment	---	**3,447,111**	**3,447,111**
Total	**$784,153**	**$11,947,111**	**$12,731,264**

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to continue the restoration of the High Pressure Air Compressor System which services the Center's Laboratories and Test Areas. This phase provides primarily for the installation of two additional air compressors, two air storage vessels, and **12,000** feet of tie-in piping for the Wind Tunnel area. High pressure air is essential to operate all of the Center's major testing facilities.

PROJECT:

This system provides high pressure air for purging operations, wind tunnel operations, contamination control, critical pneumatic systems, scientific experiments, and neutral buoyancy activities. The existing compressors are **26** to **40** years old and very deteriorated. During recent years, compressor downtime has resulted in a **23** percent reduction in rated compressor output. Compressor downtime can commonly run into months due to the unavailability of parts. Air storage vessels continue to be downrated or removed from service due to extensive deterioration. With the High Pressure Air Compressor System already operating at capacity, the

loss of one compressor or storage vessel results in testing delays. The original facilities are not suitable for refurbishment, so they will be deactivated after the new facility is fully operational.

IMPACT OF DELAY:

Delay of this project will impact all on-going programs at the Center. Support of test programs will become increasingly unreliable due to continued equipment failure and difficulty of maintenance.

DESCRIPTION

This project provides for the installation of two air compressors with associated switch gear, air dryers, filters, and valves. The project also provides for the installation of two air storage vessels and approximately 6,000 linear feet (each) of 6-inch schedule 80 and 3-inch schedule 40 carbon steel pipe to tie the Wind Tunnel area to the existing air distribution system.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$4,700,000
Compressors	LS	---	---	600,000
Other Mechanical Equipment	LS	---	---	400,000
Piping	LS	---	---	1,200,000
Vessel	LS	---	---	2,500,000
Total				$4,700,000.

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1996 ESTIMATES
RESTORATION OF HIGH PRESSURE AIR COMPRESSOR SYSTEM
LOCATION PLAN

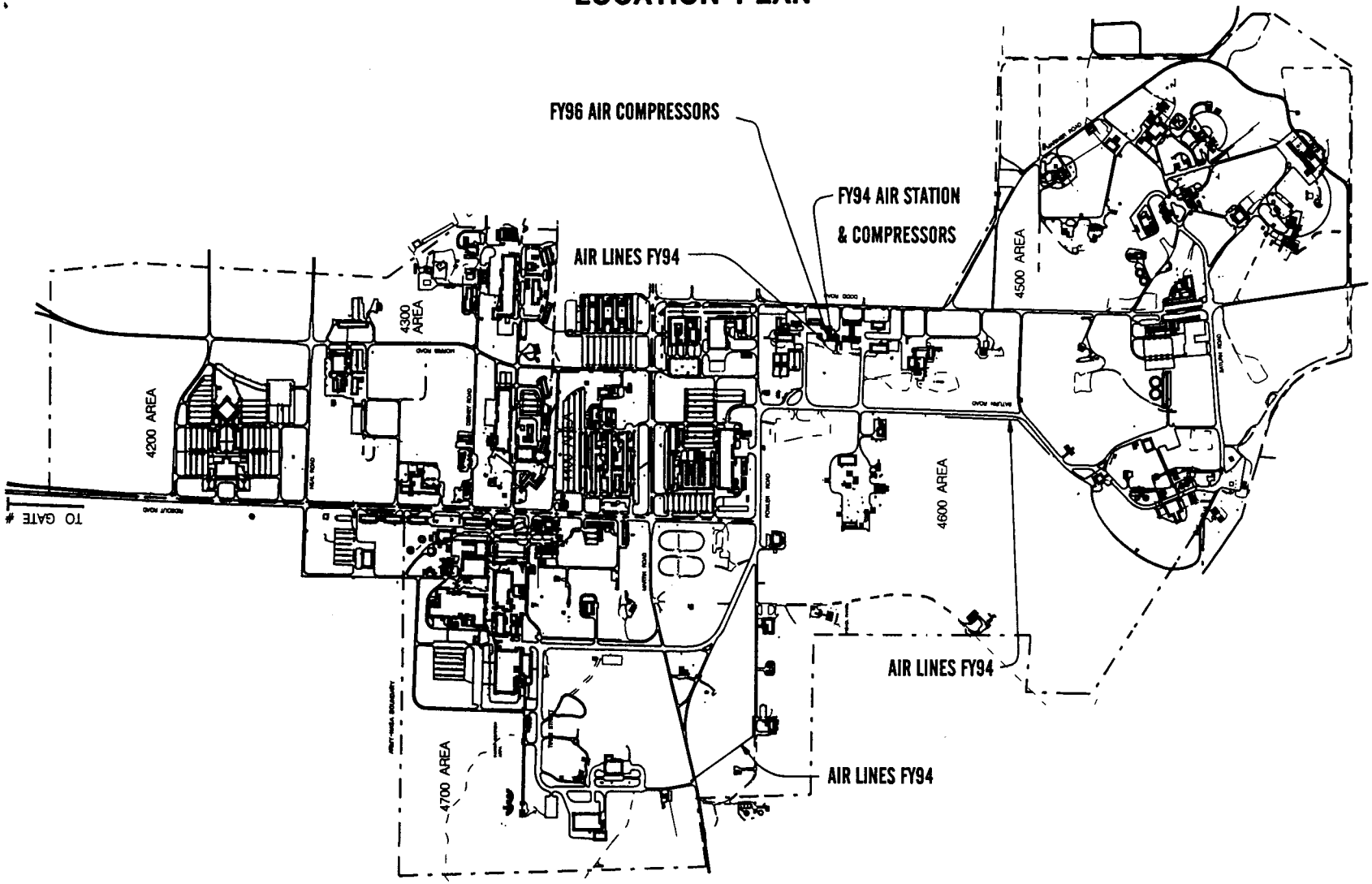


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Restoration of Information and Electronic Systems Laboratory

INSTALLATION: George C. Marshall Space Flight Center

FY 1996 Estimate: $6,800,000

LOCATION OF PROJECT: Marshall Space Flight Center, Madison County, Alabama

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$1,153,250	$ 7,455,000	$8,608,250
Capitalized Investment	---	15,737,000	15,737,000
Total	$1,153,250	$23,192,000	$24,345,250

SUMMARY PURPOSE AND SCOPE:

This project provides for the restoration and modernization of the "C" Wing of Building 4487 to create an efficient office laboratory/computer complex environment.

PROJECT:

Building 4487, totaling 278,385 square feet, was built in phases beginning in 1957 and has transitioned in use from a laboratory building to an office/laboratory/computer complex. The facility is the Center's primary electronics laboratory, supporting current NASA programs as well

as research and development for future programs. Installation of laboratory and computer equipment has overloaded both power supply/distribution and heating, ventilating, and air conditioning (WAC) systems, resulting in frequent system failures. The facility workplace environment is markedly substandard with inadequate and unreliable HVAC system, poor space allocaton/ configuration, and deficient supporting utility systems. Widespread use of asbestos in this building further complicates its utilization. Original construction of non-insulated masonry exterior walls and casement windows results in the building being extremely energy inefficient. This project will correct these problems and create useable work space so that complete functions can interact in close proximity to each other.

IMPACT OF DELAY:

Increased laboratory and computer equipment failures will occur due to deteriorated power distribution and WAC overloads. Operation and maintenance expenses will continue to increase to support piecemeal repairs. Worker productivity and morale will continue to decrease as staffs are consolidated into what is already a poorly configured, overloaded, and low quality workspace.

PROJECT:

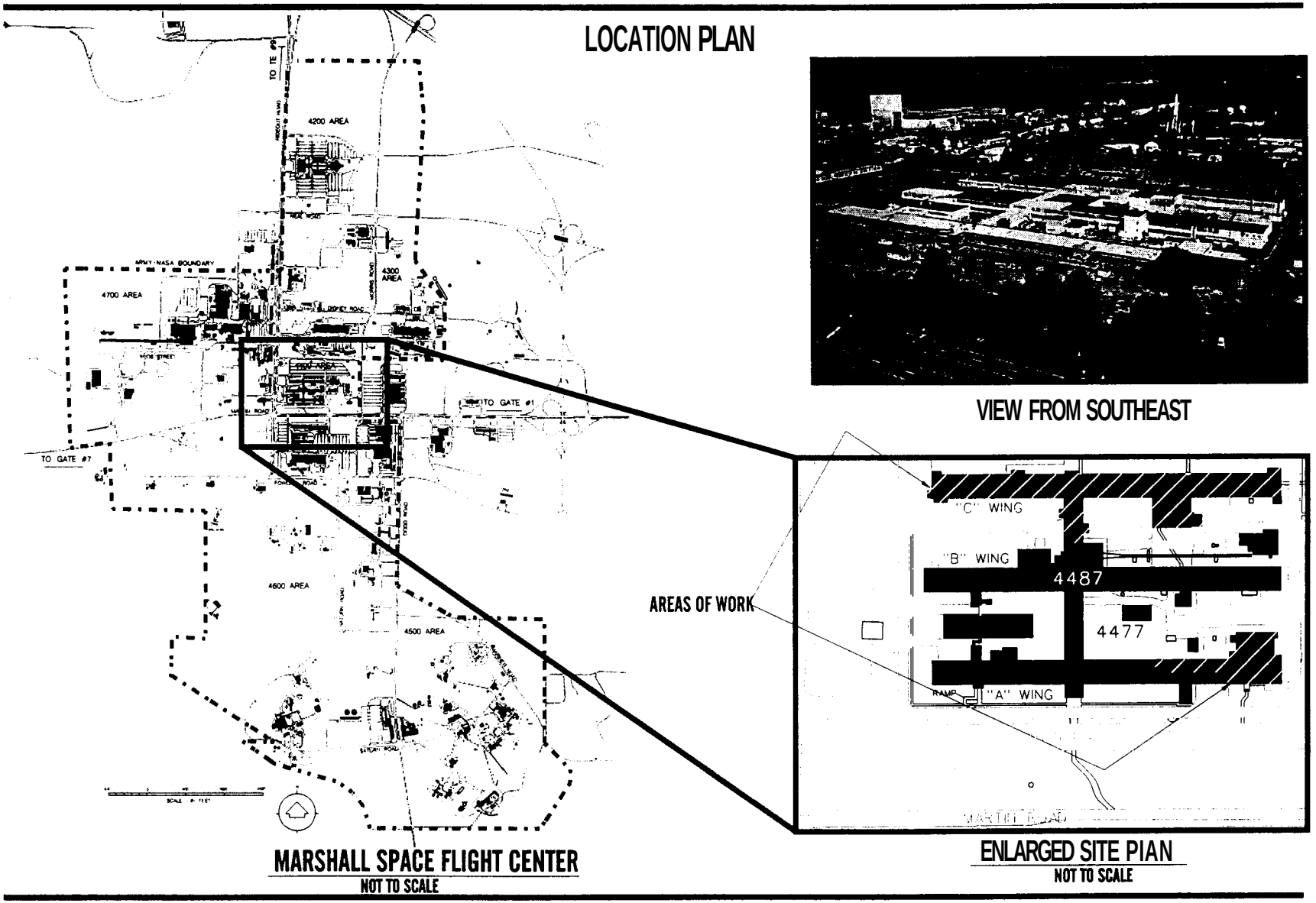
This project provides for complete restoration of the "C" Wing of Building 4487. The building exterior will be insulated and will receive a new facade, including windows. Asbestos laden interior walls will be removed. Floor, wall, and ceiling surfaces will be upgraded. The WAC system, the plumbing system, the power supply and distribution system; and the lighting system will be replaced. The project also provides for the restoration of a small sector of "A" Wing.

PROJECT COST ESTIMATE:	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$6,800,000
Site Work	LS	---	---	---
Architectural/Structural	LS	---	---	2,740,000
Mechanical	LS	---	---	2,430,000
Electrical	LS	---	---	1,270,000
Asbestos Abatement	LS	---	---	360,000
Total				$6,800,000

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1996 ESTIMATES
RESTORATION OF INFORMATION AND ELECTRONIC SYSTEMS LABORATORY



CF 3.1-30

FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Restoration of Canal Lock

INSTALLATION: John C. Stennis Space Center

FY 1996 Estimate: $1,400,000

LOCATION OF PROJECT: Stennis Space Center, Hancock County, Mississippi

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$112,000	---	$ 112,000
Capitalized Investment	---	$9,591,997	$9,591,997
Total	$112,000	$9,591,997	$9,703,997

SUMMARY PURPOSE AND SCOPE:

This project provides for the restoration of the navigational lock to ensure continued reliability and maintainability of the lock supporting testing programs at Stennis Space Center including the Space Shuttle Main Engine (SSME) testing program.

PROJECT:

Nine propellent barges supply liquid nitrogen and oxygen to the SSME Test Stands during SSME test operations. The navigational lock is a critical element in the barge transportation system. Repeated deferrals of major repairs have resulted in accelerated deterioration and increased maintenance costs.

IMPACT OF DELAY:

A delay in the implementation of this project increases the potential for a failure within the navigational lock system with an adverse impact to the SSME testing operations.

PROJECT:

This project provides for the restoration of the navigational lock. The work includes restoration of the cathodic protection system of the lock; cleaning and repainting rusted surfaces; mechanical overhaul and structural repair of the upper and lower canal lock gates; and repair or replacement of the valves, pumps, controls, and electrical wiring at the lock pumping station.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$1.400: 000
Overhaul/Repair Locks	LS	---	---	1,200,000
Upgrade Pumping Station	LS	---	---	200,000
Total				$1,400,000

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

STENNIS SPACE CENTER
FISCAL YEAR 1996 ESTIMATES
RESTORATION OF CANAL LOCK

LOCATION PLAN

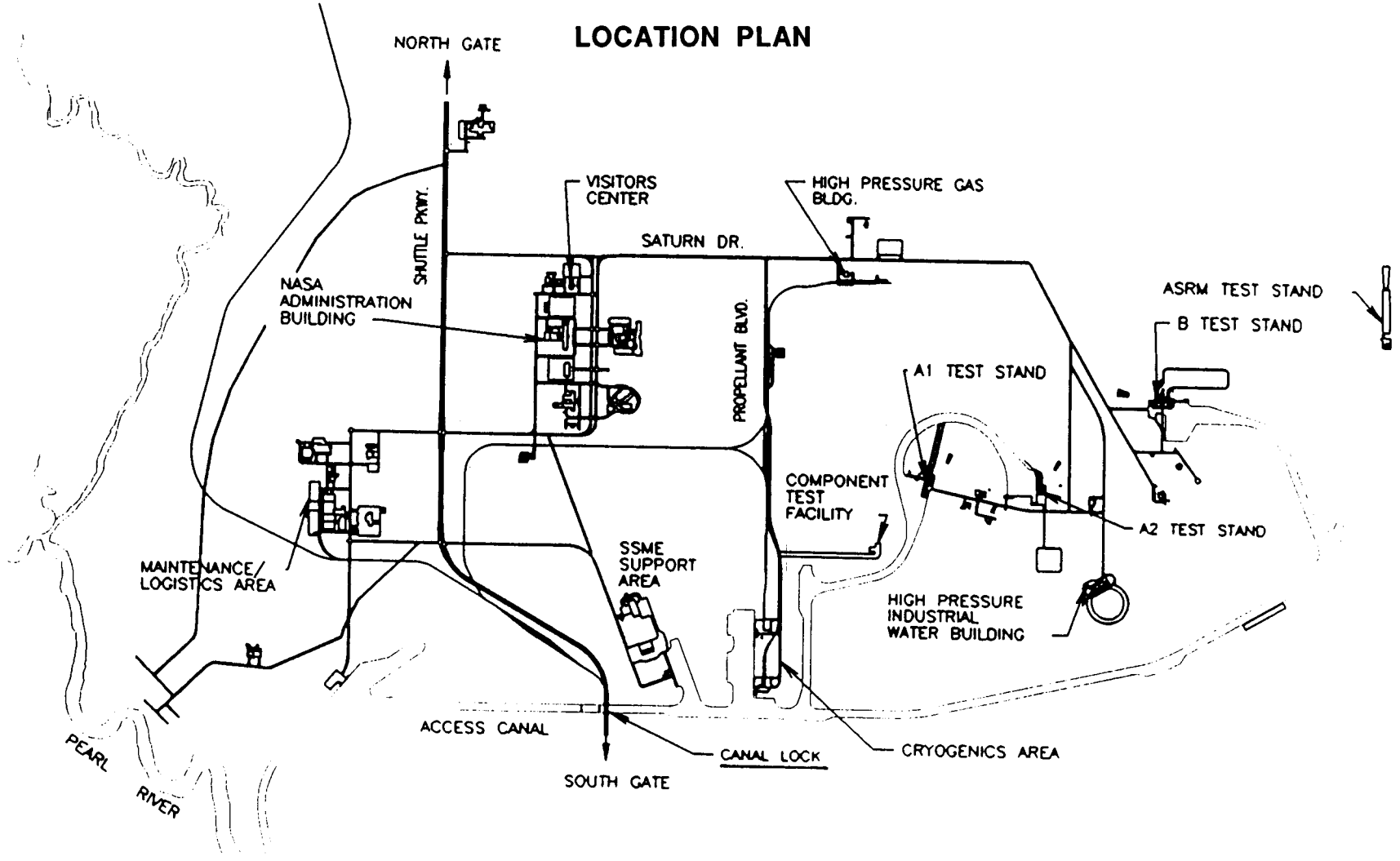


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Restoration of Primary Electrical Distribution Svstem

INSTALLATION: Wallops Flight Facility

FY 1996 Estimate: S2.500.000

LOCATION OF PROJECT: Wallops Island, Accomack County, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Mission to Planet Earth

FY 1995 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific Construction Funding	$237,320	---	$ 237,320
Capitalized Investment	---	$5,740,664	5,740,664
Total	$237,320	$5,740,664	$5,977,984

SUMMARY PURPOSE AND SCOPE

The project provides for the restoration of the primary high voltage electrical distribution system on the Main Base at Wallops Flight Facility. The modification will replace a 2.4kV and 12.5kV above ground distribution system with an underground system designed to satisfy current and future research and development requirements.

PROJECT JUSTIFICATION:

The high voltage distribution system on Wallops Main Base is 40 years old and is approaching the end of its expected useful life. It requires excessive repairs and maintenance to minimize

failures and power outages to facilities. The overhead electrical distribution system to various facilities is difficult and dangerous to maintain and operate due to its location over parking areas, streets, and buildings. An underground distribution of primary electrical service to the facilities housing research tracking and other related support activities will be more reliable, safer, and easier to maintain.

IMPACT OF DELAY:

Power outages will continue to threaten damage to sensitive and high valued equipment. Operations will continue to be delayed by inefficient short-term repairs to the electrical distribution system.

PROJECT:

This project provides for the restoration of the Wallops Flight Facility electrical distribution system on the Main Base. It includes the removal of 4,600 circuit meters of overhead (2.4kV and 12.5kV) distribution system and replacement with a new 12.5kV underground system. The new system will also include concrete duct banks, transformers, switchgear, manholes, and secondary feeder services.

PROJECT COST ESTIMATE:	Unit of Measure	Quantity	Unit Cost	Cost
Construction	---	---	---	$2,500,000
Existing Electrical System Removal	LS	---	---	200,000
New Underground Electrical System	LS	---	---	2,300,000
Total				$2,500,000

LIST OF RELATED GRAPHICS: Figure 1 - Location Plan

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED TO COMPLETE THIS PROJECT: None

WALLOPS FLIGHT FACILITY
FISCAL YEAR 1996 ESTIMATES
RESTORATION OF PRIMARY ELECTRICAL DISTRIBUTION SYSTEM

LOCATION PLAN

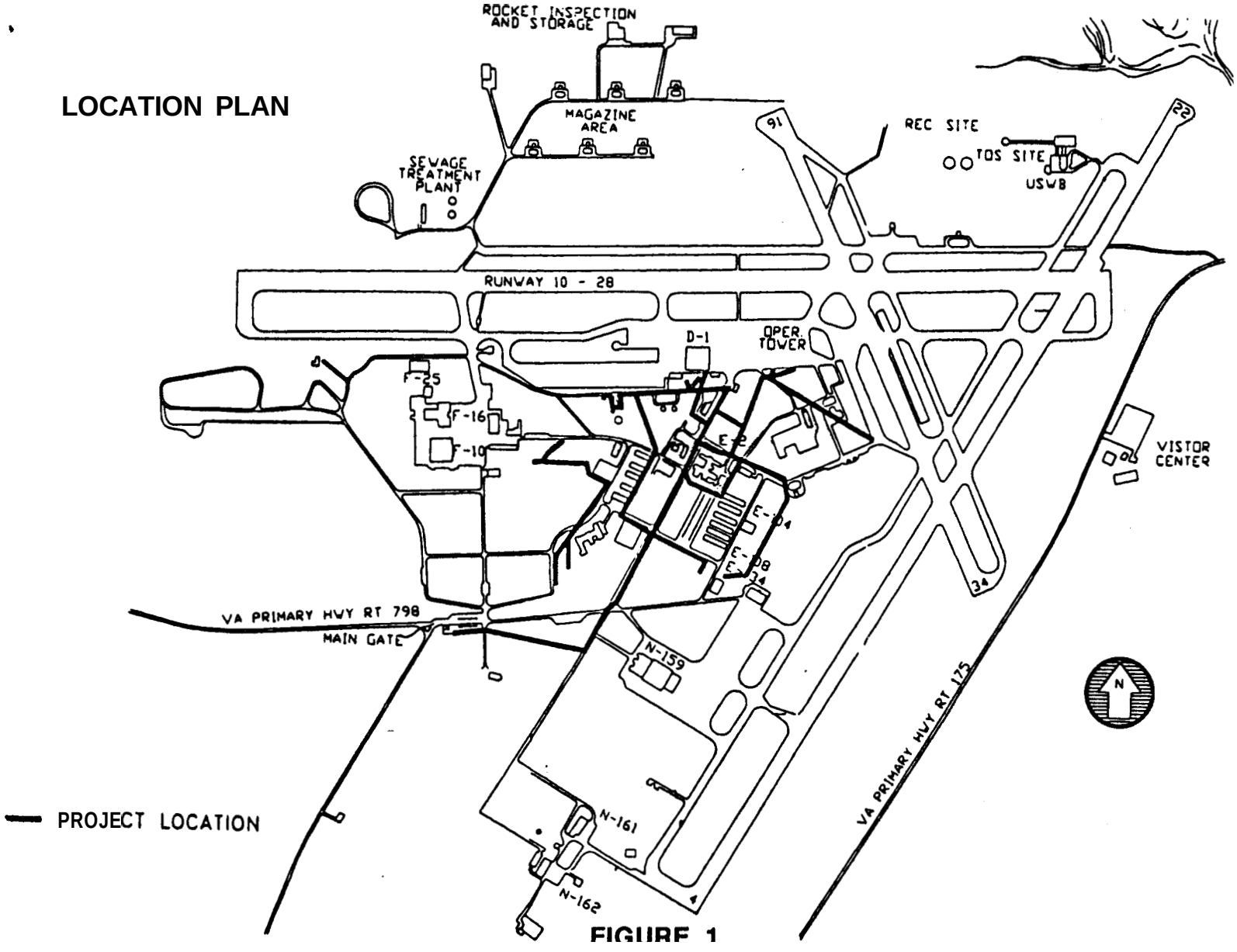


FIGURE 1

CF 3.1-36

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

SUMMARY

REPAIR

Summary of Project Amounts by Location:	Amount	Page No.
Ames Research Center	$3.550. 000	CF 3.2-3
Dryden Flight Research Center	1.320. 000	CF 3.2-4
Goddard Space Flight Center	2.800. 000	CF 3.2-5
Jet Propulsion Laboratory	2.600. 000	CF 3.2-6
Johnson Space Center	2.750. 000	CF 3.2-7
Kennedy Space Center	3.750. 000	CF 3.2-8
Langley Research Center	4.270. 000	CF 3.2-9
Lewis Research Center	3.550. 000	CF 3.2-10
Marshall Space Flight Center	4.300. 000	CF 3.2-12
Michoud Assembly Facility	1.350. 000	CF 3.2-13
Stennis Space Center	1.850. 000	CF 3.2-13
Wallops Flight Facility	2.500. 000	CF 3.2-14
Miscellaneous Projects Not in Excess of $250. 000 Each	410,000	CF 3.2-15
Total	$35.000. 000.	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Repair of Facilities, Not in Excess of $1,500,000 Per Project

INSTALLATION: Various Locations

FY 1996 Estimate: $35,000,000

FY 1994: $36,000,000 FY 1995: $30,000,000

COGNIZANT INSTALLATIONS/LOCATIONS OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management Systems and Facilities

SUMMARY PURPOSE AND SCOPE:

These resources will provide for critical repairs to facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. Included in the request are those facility repair needs for FY 1996 that can be identified at the time of the submission of these estimates and are not in excess of $1.5 million per project. The thrust of this program is to restore facilities and components thereof, including collateral equipment, to a condition substantially equivalent to their originally intended and designed capability. The request includes the substantially equivalent replacement of utility systems and collateral equipment necessitated by incipient or actual breakdown. This work also includes major preventive measures that are normally accomplished on a cyclic schedule.

PROJECT JUSTIFICATION:

NASA is now experiencing "block obsolescence" where a substantial portion of the agency's facilities have been in use for over 25 to 30 years. Repair costs for mechanical and electrical systems in a typical building are almost three times higher after system operations exceed 15-20 years than they are during the initial years. Many electrical and mechanical components reach the end of their serviceable or economic life at the 20 year point and should be replaced in the interest of long-term economy. Continued piecemeal repair of these components is more costly in

the long run than replacement at the end of the economic life of the original components. Approximately 90 percent of NASA's physical plant has been in service for over 25 years.

A major thrust of this repair program is to help preserve the capabilities of the NASA physical plant, which has a capital investment of $5.5 billion and a current replacement value of more than $15 billion. This work must be addressed and progressively accomplished. Otherwise, risks ace increased and future repair costs will be significantly greater. More importantly, there will be increased breakdowns, interruption of critical operations, and costly unscheduled repairs incurred.

This program includes only facility repair work having an estimated cost not in excess of $1 million per project. The work is of such a nature and magnitude that it cannot be accomplished by routine day-to-day facility maintenance and repair activities. Repair projects estimated to cost more than $1.5 million are included as separate discrete projects in the budget request.

PROJECT DESCRIPTION:

Proposed repair projects for FY 1996 totaling $35 million are described under "PROJECT COST ESTIMATE." This repair program has been distilled from requests in excess of $54 million, and thus represents a modest request in relation to the continuing backlog of this type of work. The projects that comprise this request are of the highest priority based on relative urgency and expected return on investment. Deferral of this mission-essential work would adversely impact the availability of critical facilities and program schedules. Projects estimated to cost not in excess of $250,000 have not been individually described or identified by Center. The total request for this category is $410,000.

During the course of the year, it is recognized that some rearrangement of priorities may be necessary. This may force a change in some of the items to be accomplished. Any such changes, however, will be accomplished within total available repair resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE":

a.	Utility Systems	$ 9,850,000
b.	General Purpose Buildings	5,800,000
c.	Technical Buildings/Structures	8,910,000
d.	Pavements and Drainage	5,720,000
e.	Building Exteriors and Roofs	4,720,000

PROJECT COST ESTIMATE:

A. **Ames Research Center (ARC)** **$3,550,000**

1. **Repair Underground Sanitary Sewer System** **580,000**

Approximately **1,250** meters of sewer will be repaired in this project. Repairs will include placing lining material in existing pipe and spot replacements. The system is over 40 years old and **has** been subjected to earthquakes, encroaching tree roots, and other damage. The piping and joints are cracked causing waste to seep into the ground and ground water to infiltrate into system causing increased sewage treatment cost. Tree roots have caused numerous blockages severe enough to cause waste to back up into buildings.

2. **Repair of Pressure Systems (N229A)** ***660,000***

This project will replace or repair as needed 21,000 kPa piping distribution systems and interstage piping associated with the compressors located in the 3.5-foot Hypersonic Wind Tunnel Auxiliaries Building (N-229A). The recently completed pressure systems recertification inspections have revealed a major portion of the interstage piping for the compressors is of substandard quality. If weld failure occurs, it would pose danger to the system, the building, and to human life.

3. **Repair Steam Vacuum System Lines (N234A)** **400,000**

This project will replace the high pressure steam lines in the Steam Vacuum System (SVS) of the Thermal Protection Laboratory Boiler Building. The recently completed in-house inspection of the high pressure steam lines in the SVS determined that all welds in the system were potentially defective due to substandard welding procedures. Twenty percent of the welds were radiographically inspected and all possessed non-acceptable weld defects that could result in piping failures while in service. If failure occurs, it would pose a danger to the system and human life.

4. **Repair of 80 X 120 Wind Tunnel Access Doors** **480,000**

This project will improve the latching mechanisms and limit switches, and will provide maintenance access platforms and ladders. In order to perform maintenance or safety inspections on the doors, maintenance personnel currently must climb out onto the structures high above the ground and crawl to the latching mechanisms to service them. This inherently unsafe practice is not acceptable by NASA and OSHA standards. Failure to install ladders and platforms may result in injury or loss of life.

5. **Repair Water Distribution System** **580,000**

This project will replace various components of the Ames and Moffett Field center wide potable and fire water distribution systems. The majority of piping, valves, and regulators for the water distribution systems are approaching 50 years of age. This, coupled with corrosive subsurface conditions has degraded the components to an unreliable state. Failure to repair the

water distribution systems could cause damage to existing facilities, injury to personnel, and contamination of potable water supply.

6. Replace Water Pumps (N234) 460,000

This project will increase the reliability of the Thermal Protection Laboratory Cooling Water System supporting the testing performed in N234A and N238, by replacing the high pressure cooling water pumps, motors, and bases. These pumps provide critical cooling water to the high energy Arc Jet Electrode Assemblies, Constricted Arc Column, Nozzle Throat Section, and Power Bus Subsystem. Pump failure with a corresponding drop in cooling water flow-rate could create catastrophic failure of equipment 'and danger to personnel.

7. Repair Duct Work (N239) 390,000

This project will repair existing duct work in the Life Sciences Research Laboratory. Internal sound insulation will be removed and ducts, air handlers, and components will be cleaned. Access panels will be installed for duct and heating coil maintenance. A wall will be constructed around the air intake vent to eliminate excess dirt and fume ingestion. Building N-239 lab areas require 100 percent outside air. Over the years dirt and dust have accumulated in ducts and equipment. The high velocity and air volume in the ducts disturbs the dust and creates particulate flow throughout the building.

B. Dryden Flight Research Center (DFRC) $1,320,000

1. Repair Dryden Central Steam Plant (4886) 240,000

This project replaces the existing system with two new 112 kW natural gas fired steam boilers, de-aerator and condensate recovery system, associated piping, computerized water treatment system, and an air pollution control system. Building 4886 is the main source of heat for Building 4800, Dryden's largest building, and two of Dryden's major hangars, Buildings 4801 and 4802. This system was constructed in 1954 and all components have exceeded their useful life expectancy. The steam distribution system, including air handlers and distribution piping, is already in place, but the boiler must be replaced in order to make the system efficient.

2. Repair Dryden 35,000 Volt Circuit 450,000

This project will replace an unreliable power transmission system between Substation 16 and Building 4840 with a new six-way duct bank with individual cables feeding each transformer from Substation 16. Manhole E-25A will be removed and replaced due to violation of National Electrical Codes. If existing 35 kV feeder cables were to fail, the failure or explosion would damage the duct, making it impossible to remove the damaged cable or to pull a new cable in the damaged duct. The existing transformers have no separate over-current protection within the manhole, so if one transformer fails, they all fail.

3. Repair Roads, Paving, and Main Parking Area 630,000

This project provides for the repair of roads, paving, and parking areas including some flight line areas. The work includes the repair of cracked pavement and potholes, resurfacing approximately 24,000 square meters of asphalt pavement, and the realignment of Forbes Avenue roadway. This project is needed to bring the existing roads, paving, and parking areas back into maintainable condition. Continued neglect of flight line areas will cause foreign object damage (FOD) to aircraft engines, tires, and landing gear systems, and may cause damage to aircraft ground equipment (making some areas unusable for aircraft). Forbes Avenue roadway safety is compromised due to drainage problems and poor sight distances.

C. Goddard Space Flight Center (GSFC) $2,800,000

1. Replace Roofs, Buildings 28 and 17 700,000

This project provides for the repair of portions of roofs on Buildings 28 and 17. The work involves the replacement of 4,500 square meters on the Technical Processing Facility (28) and 1,800 square meters on Administrative Support Building (17). The work includes removal of existing roof assemblies down to the structure and their replacement with new insulation and modified membrane roof system. These roofs have a history of leaks and drainage problems. The new roofing system will remedy the defects and reduce maintenance costs.

2. Repair Exterior of Research Projects Lab (2) 900,000

This project will provide for the repair of building exterior components on the north side of the Research Projects Laboratory (Building 2). The project includes replacement of existing exterior metal panel systems and windows as well as masonry repairs. In addition, this project will replace induction unit component parts, including modifications to the associated secondary water systems and air handling units. Asbestos will be removed as required. This building shows numerous signs of water damage due to deterioration of the exterior wall system. The proposed work will restore facility integrity and minimize potential loss of government property due to water damage.

3. Repair Air Handling Units and Controls, Buildings 16 and 26 650,000

This project provides for the replacement of air handling unit components and related piping and controls in Logistic and Supply Facility, Building 16 and Space Science and Data Center, Building 26. Asbestos will be removed as required. The existing control valves for the induction units need to be replaced because they frequently malfunction after becoming clogged with scale. Other components which have deteriorated and need to be replaced include the induction unit drain pans, piping, and dielectric couplings. Heat exchangers need to be provided in Building 26 to prevent' contamination of the secondary water system by the primary system. The air handling units in these buildings have exceeded their design life and are inadequate for their present usage.

4. Repair Electrical Systems, Various Buildings 550,000

This project provides for the replacement of motor control centers in Building 5. In addition, replacement of individual wall mounted motor starters in Buildings 16, 17, 18, 19, 20, and 25 with centralized motor control centers is included. This project is required to replace electrical equipment which is in poor condition due to age and excessive usage. The equipment is obsolete and replacement parts are often not available. Replacement of this equipment will improve maintainability and reliability.

D. Jet Propulsion Laboratory (JPL) $2,600,000

1. Repair Curtain Wall, Space Flight Support Facility (264) 900,000

This project will repair approximately 2,200 square meters of existing curtain wall on the north and east facades of this eight story building. A new curtain wall system will be attached to the exterior of the existing system utilizing the existing vertical mullions for structural support. The new system will include new glazing and gutters. The building has a severe leakage problem and glass plates have fallen out. Hazardous conditions have resulted from water passing through the curtain wall and soaking the carpet, electrical cords, and equipment.

2. Refurbish Corridors, Control Systems Laboratory (198) 650,000

This project will replace approximately 730 square meters of deteriorated, outdated finish details. The work includes replacement of ceiling panels, carpeting, and painting. New duct work will be provided for the return air plenum. All doors will be replaced with 20 minute fire rated doors. The building has been converted from laboratory space to offices with a significant increase in building population. Renovation of the heating, ventilating, and air conditioning system is required to eliminate the corridor as a return plenum. Return air registers at the end of the corridors will be removed and openings closed. The corridors are being renovated to provide fire rated ceilings and doors to conform with life-safety building codes.

3. Repair Exterior, Physical Science Laboratory (183) 450,000

This project provides for the repair of approximately 2,900 square meters of the exterior surface of Building 183. The project will remove existing coatings, and repair and reseal plaster panels. Included is caulking and flashing around doors, windows, and other openings. The east and west masonry walls will be cleaned, repainted, and waterproofed. All window wall glazing in the lower lobby area will be removed and replaced. The existing plaster walls have deteriorated, cracked, and peeled. Mortar joints in the masonry walls are pitted. Caulking and flashing around windows and other openings are dried and cracked. These conditions allow water to penetrate the building.

4. Repair Paving, Upper West Parking Lot 600,000

The project will remove and replace approximately 12,000 square meters of asphalt paving on the upper west parking lot including a portion of Explorer Road and parking areas adjacent to it from Gyro Road on the west to the intersection of Pioneer Road on the east. The pavement will be removed and the area will be regraded. A new 150 mm aggregate base and 75 mm asphalt paving will be placed. Included will be a new concrete surface drainage system. The pavement is 30 years old and is severely deteriorated. Slurry coating is not justifiable as the sub-base is unstable and would not hold up under constant traffic. In addition, approximately 50 more parking spaces will be created by restoring the lot with 2.5 meter stalls.

E. Johnson Space Center (JSC) 2,750,000

1. Repair Access Road, White Sands Test Facility 900,000

This project provides for repair of the main access road to the White Sands Test Facility (WSTF). The work consists of repairing the approximately 9.7 kilometer long by 7.3 meters wide road. The repair will include crack sealing of approximately 76,100 square meters of existing pavement and laying a 51 millimeter thick hot mix overlay. In addition, the shoulders will be raised to match the new surface, settling basins will be dug at locations on the upstream side, and the downstream shoulders will be engineered to prevent undercutting. The access road has not had a major repair since it was constructed in 1963. Normal wear and tear over the last 31 years, plus additional heavy construction traffic in the last 15 years, have made the replacement of the surface necessary. Without major repair and a new surface, continued degradation of the road will result in major damage to the road base necessitating a considerably more expensive repair.

2. Repair Aircraft Operations Facilities, Various Buildings, Ellington Field 500,000

This project provides for selective repair and/or replacement of architectural, structural, mechanical, and electrical systems in various buildings at Ellington Field. The work includes replacement of interior and exterior building and roofing components, access modifications, air conditioning and condensing units, electrical panels, transformers, lightning protection, wiring, and lights. The facilities are over 40 years old and many of the buildings' components and systems have exceeded their life expectancy. These repairs will bring the buildings up to current life safety standards.

3. Repair Avionics Systems Laboratory Mechanical Systems (16) 900,000

This project provides for repair of heating, ventilating, and air conditioning (HVAC) equipment in the Avionics Systems Laboratory. Also included is the installation of an automatic sprinkler

system. Work includes the repair/replacement of air-handler casing and structures, valves, and fan scroll assemblies. The existing outdated HVAC control systems will be replaced with energy efficient controls. This project will replace primary HVAC equipment that is over 30 years old and beyond its useful life. The new HVAC system will provide efficient, reliable, and economical service to the facility.

. 4. Repair Roads, Various Locations 450,000

This project provides for major repairs of roads at the center. The work includes five district locations along First, Second, Fourth, and Fifth Streets. The work will include the replacement of base material, replacement of worn surface material, and striping/marking for identification and traffic control. The center's roads are at the end of their service life and have received only minimal surface maintenance since construction in 1962.

F. Kennedy Space Center (KSC) $3,750,000

1. Replace Roof, Vertical Processing Facility 480,000

This project replaces approximately 2,200 squares meters of deteriorated built-up roofing on the Vertical Processing Facility. The roof has failed to the extent that maintenance and repair actions can no longer provide watertight integrity. Work includes removal and replacement of roofing, insulation, gutters, downspouts, and lightning protection.

2. Repair Wharf Slip at Hangar AF *800,000*

This project repairs approximately 200 meters of failing seawall at the Hangar AF Wharf Slip. The seawall has had recent interim repairs in an attempt to slow structural degradation until this permanent repair can be accomplished. Sheet piling will be sealed, backfill replaced, with adjacent concrete slabs stabilized and/or replaced, as appropriate.

3. Replace Utility Annex Pumps and Controls 700,000

This project replaces three deteriorated firex pumps for which spare parts are no longer available. The project will also provide for a new recirculation/test line at the utility annex. Internal inspections have revealed severe deterioration and erosion.

4. Remove/Install Bridge Expansion Joints, Banana and Indian River Bridges *600,000*

This project replaces approximately 1,500 meters of bridge deck expansion joints on the Banana and Indian River bridges. Deterioration of existing joints is jeopardizing the structural integrity of the two bridges.

5. Repair Roads and Paved Areas, Various Locations 600,000

This project repairs approximately 60,000 square meters of paving throughout the Kennedy Space Center. Surface courses will be sealed or replaced as appropriate, base courses repaired or replaced as necessary, and restriping accomplished. Surface water runoff control will also be provided as required by environmental regulations.

6. Repair Flame Deflection Systems 570,000

This project repairs deteriorated flame deflectors which are part of Space Shuttle Launch Complex Pads A and B. Launch vibrations have caused large sections to separate during vehicle lift off. Flame retardant concrete and steel coatings, will be replaced, as well as corroded structural steel components. The project will also evaluate alternate positions for the deflector units in an effort to reduce the corrosive effect of launch activity.

G. Langley Research Center (LaRC) $4,770,000

1. Repairs to Central Heating and Steam Generating Facility (1215) 900,000

This project provides for the replacement of the existing control systems for the boilers, air compressors, and the central alarm system at the Central Heating and Steam Generation Facility which serves LaRC's West Area. The new central control station will be environmentally enclosed and controlled. The project will include an approximately 93 square meter addition to the facility to offset the space required by the replacement control station. The existing control panel is over 45 years old and requires replacement to assure continued safe operation, reduce maintenance, and increase reliability and efficiency.

2. Replace Liquid Rheostat Serving Unitary Wind Tunnel (1251) 920,000

This project provides for the replacement of the existing liquid rheostat which provides control of the electrical power to a pair of synchronous main drive motors for the Unitary Wind Tunnel. The work to be accomplished includes the removal of the existing liquid rheostat, modifications to piping and wiring to provide for the installation of the new equipment, and the installation of a new liquid rheostat and associated mechanical and control components. The liquid rheostat was installed in the mid 1950's and replacement parts are difficult to locate. Failure to replace the liquid rheostat as scheduled will result in increased losses of tunnel operating time and possible shutdown of the facility if a catastrophic failure occurs.

3. Repairs to High Pressure Systems, Various Facilities 700,000

This project provides for the repairs to the high pressure systems at various facilities. The work to be done under this project includes the replacement of defective piping, valves, and fittings; radiographic inspection of welds; and repair of defective welds. The systems to be repaired include piping systems and pressure vessels at the West Area Steam Generating Facility (1215), the Steam Distribution System, the Jet Exit Test Facility, the East Area Compressor Station (646), and the Unitary Wind Tunnel (1251). These systems are being analyzed and spot inspected under Langley Research Center's ongoing Recertification Program. Completion of this project is essential to ensure the safe and efficient operation of these facilities.

4. Replacement of Substations, Various Locations 900,000

This project provides for the replacement of 208 volt substation "LF-100," 480 volt substation "PF-100," and 480 volt Substation Number 5. The project will include replacement of the air switch, secondary switchgear, and drawout circuit breakers for each of the substations. The switchgear, breakers, and primary air switch for each substation are obsolete and replacement parts are difficult to obtain. Substations "LF-100" and "PF-100" are over 40 years old. The replacement of these substations will reduce maintenance, reduce downtime, and improve system reliability and safety for the five facilities served.

5. Replace Roof, Engineering Building (1209) 850,000

This project provides for replacement of approximately 4,830 square meters of existing built-up roofing on the Engineering Building (1209). The new roof will consist of tapered rigid roof insulation to provide a 2.08 centimeter per meter slope covered by a 4-ply built-up roof system. The new roof will be complete with roof drains and associated plumbing, flashing, fascia, pitch pockets, cant strips, gravel stops, and new expansion joints as required. Water which has become trapped between layers of the 17 year old built-up roofing causes the roof to expand due to temperature changes, causing further damage. The roof replacement is necessary to ensure the integrity of this facility and to prevent damage to critical engineering and planning files, original drawings, and computer systems.

H. Lewis Research Center (LeRC) $3,550,000

1. Repair Central Water System, Walcott and S. Taylor Roads 900,000

This project provides for the repair of the central water distribution system. The work includes the replacement or cleaning/relining of corroded and clogged water mains and replacement of all shutoff valves and fire hydrants located along Walcott and S. Taylor Roads. This project will increase water pressure and improve water quality for the various buildings being serviced from

the water mains. Mineral deposits on the inside of the water mains have caused a general reduction in water flow and water pressure throughout the Center. This project is part of a multi-year program to increase water pressure and improve water quality for the various buildings served.

2. Repair Steam Trenches, Outlying Areas II 900,000

This project provides for the repair and replacement of piping and valves at locations near Buildings 24, 34, 107, 45, 87, and 88 in the central steam distribution system. The locations will also require road excavation, trench cover replacement, drainage and manhole repairs, piping and valve reinsulation, trench water level sensor installation, roadway resurfacing, and site restoration. Existing conditions include collapsed sections of trench and roadway; severe concrete deterioration due to road salts and freeze-thaw cycling; advanced corrosion of condensate piping and pipe supports due to the trench environment; and poor condition of steam line insulation, valves, and expansion joints. This project will provide safe, reliable steam service to critical research buildings and administrative functions.

3. Replace Research Analysis Center Roof (142) 450,000

This project provides for the installation of a new roof on the low and high roof areas of the existing building. The work includes a new built-up roof membrane, insulation, and flashing. The existing roof membrane has separated in various locations and has caused roof leaks into the operations center below. The new roof system will prevent possible damage to sensitive computer equipment in the operations center.

4. Repair 2400 Volt Switchgear, Substation G 900,000

This project provides for the rehabilitation of the 2.4 kV switchgear in Substation G (43). It will replace the existing 2.4 kV outdoor metal-clad switchgear with modern switchgear, replace the associated 34.5 kV-2.4 kV transformer with a new voltage regulating transformer, and redistribute feeder cable to balance substation loading. This project will improve reliability and reduce the high level of maintenance needed to keep the system operational for the institutional and critical research loads.

5. Repair Guerin Road 400,000

This project provides for the repair and replacement of the water mains, hydrants, gas lines, and pavement of Guerin Road. The existing hydrants and transite water main will be removed and replace to repair the water system. Full depth asphaltic pavement will be utilized to repair the road surfaces and the high pressure natural gas line will be repaired and replaced to provide low

pressure gas service. Repair and replacement of the underground utilities is required to meet code requirements and to increase system reliability and safety.

I. Marshall Space Flight Center (MSFC) $4,300,000

1. Repairs to Past Test Area Industrial Water Pump House (4567) 800,000

This project provides for the installation of a new 26,000 liters-per-minute diesel-driven pump with associated piping and controls to replace three non-operating units in the East Test Area Industrial Water Pump House. The three non-operating units with their associated piping and obsolete controls will be removed and cannibalized to maintain four similar units which remain operational. The pumps being replaced are out of production and parts are no longer available. This project will reduce the potential for outages during testing activities.

2. Repairs to High Pressure Piping System 900,000

This project provides for the replacement of approximately 3,500 meters of high pressure gas piping and associated components throughout the Center. This piping is part of the high pressure distribution system for hydrogen, helium, nitrogen, and high purity air. This system provides critical support to major test programs. It is very old, deteriorated, and continued piecemeal repairs are costly and disruptive to testing activities.

3. Repair Roads and Paved Areas, Various Locations 800,000

This project provides for the repair and resurfacing of approximately 70,000 square meters of deteriorated roads, parking areas, and hardstands. Scope includes repair of damaged base course, application of tack coats, overlaying with asphaltic paving and/or seal coat, and painting of parking stripes and road markings. Deteriorated concrete pavements will be repaired by replacement of damaged slabs and joint sealing materials. These road surfaces and hardstands provide primary access to key test, development, and production facilities.

4. Repair Interior of Power Systems Laboratory (4475) 900,000

This project provides for repairs to the interior of Building 4475. Scope includes the replacement of the heating, ventilation, and air conditioning system; and restoration of the electrical distribution and fire alarm systems. Also included is the restoration of the interior surfaces, restrooms, interior lighting, emergency exit signs, etc. Building 4475 is a 1,200 square meter high bay facility. It is 30 years old and maintenance intensive. Restoration of this facility will bring it into compliance with applicable codes, reduce operating costs, and significantly improve its functionality.

5. Repair Roof of Developmental Processes Laboratory (4711) 900,000

This project provides for repairs to the roof on Building 4711. Work includes installation of an R-30 roof insulation system; a 6,400 square meter sloped standing-seam metal roof; new gutters, downspouts, and interior drains; replacement of flashing; and removal of unnecessary expansion joints and vents. The existing roof has already exceeded its life expectancy and is very deteriorated. Repair of this roof will preserve the integrity of the facility, reduce maintenance costs, and provide energy cost savings.

J. Michoud Assembly Facility (MAF) $1,350,000

1. Repair Component Ablator Thermal Oxidizers (318) 850,000

This project provides for the repair of two thermal oxidizers in the Component Ablator Facility, Building 318. The thermal oxidizers are suffering from metal fatigue, premature chamber buckling and distortions, inadequate ductwork, and a poorly configured exhaust system for the current layout and use of the facility. Scope includes repair or replacement, as necessary, of all the major components of the thermal oxidizer system, including the refractory lining, the flow control valves, the inlet and exhaust valves, and the repair and painting of all rusted metal components. These repairs are required to ensure the mechanical integrity and reliability of the two thermal oxidizers which support External Tank production critical operations.

2. Repair Roads and Paved Areas, Various Locations 500,000

This project provides for the repair and resurfacing of approximately 40,000 square meters of deteriorated roads. Scope includes repair of damaged base course, application of tack coats, overlaying with asphaltic paving and/or seal coat, and painting of road markings. Deteriorated concrete pavements will be repaired by replacement of damaged slabs and joint sealing materials. The majority of the work is on Saturn Blvd. which is the route used to transport the External Tank from the Manufacturing Building to the barge dock for shipment to Kennedy Space Center.

K. Stennis Space Center (SSC) $1,850,000

1. Replace Motor Control Centers 700,000

This project provides for replacement of motor control centers (MCCs) and power distribution panels in various facilities. Most of the units are over 25 years old and spare parts are no longer available. Many of the MCC's require modifications to meet code requirements. Several of the facilities have outgrown their original MCCs and power distribution panels. This project will improve reliability, maintainability, and provide safe electrical systems for various

site/test, maintenance, warehouse, engineering, logistics, and laboratory operations on the Center.

2. Repair Bascule Bridge Controls 650,000

This project provides for the replacement of electrical and hydraulic controls and related electrical wiring for the bascule bridge. The bridge is a critical element in the transportation system at SSC. The bridge controls and associated wiring require replacement to eliminate operational difficulties and delays in the bridge operations.

3. Repair Saturn Drive and Shuttle Parkway Pavement 500,000

This project provides for repairs to Saturn Drive and Shuttle Parkway. The work includes repairing cracks, fixing pavement failures, and repainting pavement markings. The pavement is severely deteriorated with ruts and cracks. These repairs are required to prevent further breakdown of the pavement structure and provide safe access at SSC.

L. Wallops Flight Facility (WFF) $2,500,000

1. Repair Secondary Electrical Systems, Various Locations 900,000

This project provides for the upgrade and replacement of power panels, wiring, distribution, substations, and switchgear. Included are modifications to electrical vaults and the 480 volt services to facilities **A-41, D-1, E-2, E-104-108,** F-7, F-8, F-10, W-65, and W-100. These secondary distribution systems are **40** years old and beyond their serviceable life expectancy. Upgrading the systems will allow Wallops Flight Facility to meet current industry standards for power distribution and enhance reliability. It will avoid the piece-meal replacement of a worn out system, reducing maintenance and downtime.

2. Repair Main Base Storm Drainage System 700,000

This project provides for the repair of various sections of **15** centimeters to **135** centimeters diameter storm drainage system piping, inlets, and manholes on the Main Base. The work will include the installation of new underground drains, swales and culverts, and all related street repairs due to storm drainage damage. This work is required to repair deteriorated storm drains and correct drainage deficiencies due to facility changes over the past **40** years. Also, the storm drainage system is a source of erosion problems due to the pipe separations. The work must be accomplished at this time to prevent additional system deterioration which could lead to the undermining of roads and structures.

3. Repair of Seawall **900,000**

This project provides for the repair of the Wallops Island seawall on the north end of Island. The construction will be seaward of the existing seawall and include all necessary toe protection. This work is necessary to prevent or minimize storm damage, which is becoming increasingly common due to beach erosion and deterioration of the existing protection system.

M. Miscellaneous Projects Not In Excess of *$250,000* Each **410,000**

Total $35,000,000

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED:

Approximately $40–$50 million per year will be required for continuing repair needs.

[redacted]

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

SUMMARY

REHABILITATION AND MODIFICATION

Summary of Project Amounts by Location:	Amount	Page No.
Ames Research Center	$3.740. 000	CF 3.3-3
Dryden Flight Research Center	900. 000	CF 3.3-4
Goddard Space Flight Center	2.920. 000	CF 3.3-4
Jet Propulsion Laboratory	3.000. 000	CF 3.3-6
Johnson Space Center	3.250. 000	CF 3.3-7
Kennedy Space Center	3.160. 000	CF 3.3-8
Langley Research Center	3.360. 000	CF 3.3-9
Lewis Research Center	3.260. 000	CF 3.3-11
Marshall Space Flight Center	3.580. 000	CF 3.3-12
Michoud Assembly Facility	1.350. 000	CF 3.3-14
Stennis Space Center	2.400. 000	CF 3.3-14
Wallops Flight Facility	890. 000	CF 3.3-15
Various Locations	2.710. 000	CF 3.3-16
Miscellaneous Projects Not in Excess of $250. 000 Each	480. 000	CF 3.3-17
Total	$35,000,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Rehabilitation and Modification of Facilities, Not in Excess of $1,500,000 Per Project

INSTALLATION: Various Locations

FY 1996 Estimate: $35,000,000

FY 1994: $36,000,000 FY 1995: $30,000,000

COGNIZANT INSTALLATIONS/LOCATIONS OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management Systems and Facilities

SUMMARY PURPOSE AND SCOPE:

These resources will provide for the rehabilitation and modification of facilities at NASA field Installations and Government-owned facilities at industrial plants and universities supporting NASA activities. Included in this request are those facility rehabilitation and modification needs for FY 1996 that have been fully identified at the time of the submission of these estimates and are estimated not to exceed $1.5 million per project. The purpose of this program may include some restoration of current functional capability but also includes enhancement of the condition of a facility so that it can more effectively accomplish its designated purpose or increase its functional capability.

PROJECT JUSTIFICATION:

The NASA physical plant has a capital investment of $5.5 billion and has a current replacement value of more than $15 billion. A continuing program of rehabilitation and modification of these facilities is required to accomplish the following:

a. Protect the capital investment in these facilities by minimizing the cumulative effects of wear and deterioration.

b. Ensure that these facilities are continuously available and that they operate at peak efficiency.

c. Improve the capabilities and usefulness of these facilities and thereby mitigate the effects of obsolescence.

d. Provide a better and safer environment for all personnel.

This program includes only facility rehabilitation and modification work having an estimated cost not in excess of $1.5 million. The work is of such a nature and magnitude that it cannot be accomplished by routine day-to-day facility maintenance or by related routine facility work efforts.

PROJECT:

Proposed rehabilitation and modification projects for FY 1996 totaling $35 million are described under "PROJECT COST ESTIMATE." The total program of $35 million has been distilled from requests of $58 million and represents only a modest request in relation to the backlog of this type of work. Based on relative urgency and expected return on investment, the projects that comprise this request are the highest priority requirements. Deferral of this mission-essential work would adversely affect the availability of critical facilities, program schedules, and energy-conservation objectives. Projects estimated to cost not in excess of $250,000 have not been described individually or identified by center. The total request for this category is $480,000.

During the course of the year, some rearrangement of priorities may be necessary. This may force a change in some of the items to be accomplished. Any such change will be accomplished within available resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE:"

a.	Utility Systems	$5,715,000
b.	Fire Detection/Protection Systems	4,505,000
c.	General Purpose Buildings	7,655,000
d.	Technical Buildings/Structures	17,125,000

PROJECT COST ESTIMATE

A. Ames Research Center (ARC) $3,740,000

1. Rehabilitation and Modification of the Bioscience Lab HVAC System (N236) 390,000

This project includes removal and replacement of two main and one backup chilled water plants in the Bioscience Laboratory. It includes system controls, mechanical room chilled water piping, and pumps. Temperature control is critical in this building, which houses research animals and laboratories. The equipment is at the end of its useful life and in poor condition. Replacement parts cannot be obtained and the required temperatures cannot be consistently maintained.

2. Rehabilitation and Modification of Fire Suppression System, Flight Guidance and Simulation Laboratory (N243) 630,000

This project will install a new wet pipe automatic sprinkler system in the Flight Guidance and Simulation Laboratory. Exit corridors will be reconfigured to meet safety egress requirements. Work includes sprinklers, flow alarms, associated piping, and corridor modifications. This building contains 10,000 square meters of unsprinklered offices, computer rooms, and test laboratories. The existing fire alarm system is not audible in all areas. Completion of this project will protect occupants from fire-related injury and will protect the facility against destruction due to fire.

3. Rehabilitate Physical Science Research Laboratory for Seismic Safety (N230) 260,000

This project provides for lateral structural reinforcement of the south window wall and for strengthening of the roof diaphragm of the Physical Science Research Laboratory. After the 1989 Loma Prieta Earthquake, Ames Research Center began studies to evaluate the seismic resistance of center buildings. These studies show that this facility does not meet minimum seismic safety standards. The occupants of the facility are endangered because the building shear walls are not adequately braced in the lateral direction. This structural defect will be corrected in this project.

4. Restore Flow Control in Arc Jet Laboratory (N-238) 900,000

This project will replace air and argon flow control systems for the Panel Test Facility (PTF) and the Interactive Heating Facility (IHF) in the Arc Jet Laboratory. The existing systems have been in operation since the early 1970's. Critical parameters, such as energy enthalpy, are unobtainable with the obsolete control systems. Replacement parts are no longer available.

Principal investigators have been unable to obtain critically needed flow data required for energy balance measurements due to equipment failure and inaccurate instrumentation. This project will increase flow measurement accuracy and decrease downtime.

5. Modify Steam System, Moffett Field 860,000

This project provides for installation of individual boilers in Buildings 14, 16, 19, and 45 to replace the existing central steam heating system. The existing system was built in 1945, requires frequent repairs, and must be monitored 24 hours/day. Due to the high operational cost, it is more cost-effective to replace the existing system with individual units than to replace it in kind.

6. Rehabilitation and Modification of Experiment Support Facilities (N239A) 700,000

This project will rehabilitate and modify the Experiment Support Facilities in the south central portion of the Life Sciences Research Laboratory High Bay. Existing research areas will be consolidated and the Four-Foot centrifuge will be relocated. The consolidation and relocation of the experimental support facilities proposed in this project improve efficiency, expand the capability of ongoing programs, and enable new research approaches with both animal and human subjects.

B. Dryden Flight Research Center (DFRC) $900,000

1. Rehabilitation and Modification of Fire Alarm System 900,000

This project includes replacement of 175 field sensors, replacement/installation of Fire Alarm Control Panels in approximately 20 buildings, replacement of the Central Reporting System at Security Post #1, and other rehabilitation as necessary to comply with NASA and NFPA fire and life safety codes. The existing fire alarm system is uncoordinated and unreliable. It is a hodgepodge of systems, some antiquated and no longer supported by their manufacturer, and some are incompatible with the buildings' present uses. The increasing frequency of false alarms and the difficulty of troubleshooting and maintenance makes rehabilitation and modification imperative.

C. Goddard Space Flight Center (GSFC) $2,920,000

1. Rehabilitation of Utility Control System 850,000

This project will replace obsolete portions of the existing Utility Control System (UCS) for Buildings 23 and 25 with a state-of-the-art Direct Digital Control UCS System. Pneumatic automatic temperature controls and sensors will be replaced with new digital systems to provide reliable inputs and independent local control of air conditioning systems. This project is critical to providing effective energy conservation. The existing obsolete UCS is primarily a monitoring system and has incurred numerous operational problems such as software failures and

inaccurate sensor inputs. The new digital system will provide for an efficient, reliable, and maintainable air conditioning control system.

2. Modification of Fire Detection Systems, Various Buildings 400,000

This project provides for the modification and upgrade to the existing fire detection systems in Buildings 4, 11, 12, 20, 22, 24, 27, 28, Area 200, and Area 300. The upgraded systems will include the fire alarm control panel, annunciator panels, fire detectors, manual stations, alarms, and all wire and conduit. A master control console will be installed in Building 24 for the fire alarm systems. The existing fire detection systems are obsolete and replacement parts are not available. In order to comply with current safety standards and provide reliable operation, upgrading the fire alarm systems and replacing obsolete equipment are required.

3. Modification to Fire Protection Systems, Building 16W and Optics Test Site 400,000

This project provides for modifications to the fire protection systems in Building 16W and at the Optics Test Site (200 Area). Modifications in Building 16W include replacing inadequate standpipes, painting sprinkler piping for identification, and correcting other deficiencies. At the Optics Test Site the existing fire pump and water storage tank will be replaced. Building 16W has undersized standpipes and fire department connections. The storage tank and fire pump at the Optics Test Site have deteriorated and have become increasingly unreliable and difficult to maintain. This project will provide for the increased safety of the building occupants and the protection of property

4. Rehabilitation and Modification of Anechoic Chamber (19) 900,000

This project provides for rehabilitation of the Anechoic Chamber located in Building 19, Room N2. The project scope includes removing the existing chamber superstructure and microwave absorber, modifying its configuration, providing new pyramidal absorbers, and providing a new antenna positioner within the chamber. The resultant chamber will meet operating conditions at all projected frequencies of interest. Support spaces, including a control room and a preparation room, will be provided. Required mechanical, electrical, and fire protection system changes are included. The existing anechoic chamber is aging and in need of rehabilitation. This project is necessary in order to ensure efficient antenna development and testing.

5. Rehabilitation of Main Sewer System 370,000

This project provides for rehabilitation of the main sewer system. The work includes installing an additional 20 centimeter diameter pipe connection from the center's main sewer to the Washington Sanitary Sewer Commission sewer, cleaning and inspecting segments of the sewer system, resupporting dislocated pipe sections, providing a sewage meter, and replacing various sewage ejector pumps. Recent studies indicate that by 1997 the existing 20 centimeter diameter main sewer discharge will be inadequate for the center. This project is required to rehabilitate the existing sewer system and to meet additional demands on the system.

D. Jet Propulsion Laboratory (JPL) $3,000.000

1. Modify Mirror Refurbishment Building (313) for Environmental Testing 600,000

The project will modify Building 313 to allow installation of six thermo-vacuum and temperature-humidity chambers currently located in Building 144. The work includes constructing a concrete floor with removable hatchway over the 7 meter diameter central pit, a central air conditioning system, a free standing shed to protect mechanical equipment for the chambers, and a 750 kVA substation with disconnect switch and 600 and 400 ampere switch boards.
The project includes construction of a compressed air line from an existing line at Pioneer Road, addition of cooling water and return lines, and two secondary pumps from a closed loop system. The project will provide a liquid nitrogen distribution system to all thermal-vacuum chambers. Also, it will provide three instrumentation and communications conduits from manhole-53 to interior of building 313. This project is required to eliminate a potentially hazardous work environment due to overcrowding for the safe handling, set up of operations, and testing of flight gear.

2. Modify Uninterruptible Power Supply *(UPS)*, Space Flight Operations (230) 750,000

The project will install a third, approximately 450 kw, battery bank including bus duct and switchgear. An existing workshop, Room 27, will be modified to accept this equipment and existing electrical panels, transformers, and other work shop equipment will be relocated to Room 20. Room 20 will be modified and reconfigured to accommodate the personnel and equipment from Room 27. The project is required to improve overall UPS system reliability. Each UPS module will become a stand alone system. The additional battery string will significantly extend the UPS capability to support JPL Deep Space Network operations with lower risk from power outages.

3. Modify Information Systems Development Building (126) 900,000

The project will modify three floors of this building. The project will also upgrade the passenger elevator, relocate the machine room, and construct a corridor from the elevator to the entrance lobby. A stairway will be constructed to serve the first and second floors from the lobby area. The second and third floor restrooms will be modified for access by the disabled. Work includes new carpeting; modifications to the ceiling systems; and modifying the HVAC, power, lighting, and fire sprinkler systems. A new restroom facility to accommodate the disabled will be added to the first floor. The project is needed to house multiple and varied project requirements, and to satisfy building code and disabled accessibility requirements.

4. Modification to Low Temperature Physics Facility (79) 750,000

This project will rehabilitate approximately 650 square meters of deteriorated space in the western half of Building 79 and make provisions for access by the disabled. Exposed electrical conduits and HVAC duct work will be rerouted and abandoned conduits will be eliminated. Worn carpets and old deteriorated ceiling and lighting systems will be replaced. Low corridor ce'ilings will be raised and sloping floors on the second floor will be removed. New ceiling and lighting will be provided to replace the deteriorated system. Window awnings will be provided to the southwest end of the building to provide shade from direct sun light. A lift for the disabled will be installed, the restrooms will be enlarged, and additional fixtures added to comply with the uniform plumbing code. The corridor system will be widened and reconfigured to meet building and disabled accessibility codes. Approximately 260 square meters of eroding roadway will be replaced with new concrete curbs and swales.

E. Johnson Space Center (JSC) $3,250,000

1. Upgrade Mission Support Chillers (48) 900,000

This project provides for the replacement of a 2,460 kW chiller, with a 3,516 kW chiller and replacing the chloroflorocarbon (CFC) refrigerant on the remaining three chillers (two 2,110 kW and one 3,516 kW) in the Emergency Power Building, building 48. The work also includes replacing deteriorated structural steel members and installing two 37,850 liter diesel storage tanks. This upgrade is required because the existing chillers are too small to satisfy mission support requirements and the chillers use CFC refrigerant which must be replaced to meet environmental regulations. This project is necessary to stay within mission-critical guidelines.

2. Modifications to Photographic Technology Laboratory (8) 900,000

This project provides for modifications to the mechanical, electrical, and architectural systems in the building. Work includes replacing six air handlers, six exhaust fans, five condensing units, and associated piping. The fire suppression system will be expanded and upgraded. Also, included will be the replacement of area ceilings and installation of new lighting. Spot asbestos abatement will be performed as required. Past methods of processing photographic images have caused damage to the facility. This project is required to repair this damage and comply with Life Safety and Uniform Building Code requirements.

3. Modifications to Mission Simulation and Training Facility (5) 550,000

This project provides for modifications to the mechanical, electrical, and architectural systems in the facility. Work includes modifications to support the installation of International Space

Station mockups and a cupola. Structural platforms and a new stairway are required for the cupola installation. The project is required to support activities which include the transition form a single operator console to multi-operator workstations, the introduction of fiber optics, and additional workstation console requirements to support the glass cockpit to be utilized in Space Station simulators. This project supports verification and training programs. The existing facilities and equipment are not configured to support planned programs.

4. Modifications for Efficient Small Engine Testing, WSTF 900,000

This project provides for the modification to the existing 400 Area gaseous nitrogen altitude simulation system by using steam instead of gaseous nitrogen as the working medium. The steam supply system will incorporate water treatment, de-aeration, transfer pumps, boilers, and a fuel supply. The replacement system will be housed in an approximately 370 square meter pre-engineered building near the diesel pump pad in the 400 Area. The existing gaseous nitrogen supply system will be disconnected and the steam will be piped to new individual first stage and second stage ejectors. Operation of the steam system will be controlled from a control console and at the ejectors. Other services required (gaseous nitrogen, power, communications and paging, fire alarms, etc.) will be extended from the existing facility systems to the pre-engineered building housing the steam system. Currently, long duration tests of engines up to 4,450 newtons thrust use the 400 Area altitude system. This modification will provide a significant operational cost savings.

F. Kennedy Space Center (KSC) $3,160,000

1. Upgrade Operations and Checkout Building Elevators and Controls 400,000

This project replaces obsolete controls, valves, motors, and cables associated with elevators 2, 3, and 4 in the Operations and Checkout Building. New components are state of the art and will reduce maintenance and power consumption. Further, handicapped and fire alarm modifications will enhance personnel safety and result in the elevators complying with applicable codes.

2. Upgrade Facilities to Accommodate People With Disabilities, Various Locations *500,000*

This project modifies various buildings to make the facilities more accessible to the disabled. This effort reflects the increasing population of people with disabilities at KSC, and is intended to meet the requirements of Title 28, Code of Federal Regulations, Part 36. Work includes specialized parking, removal of curbs, installation of automatic entry doors, and lowered light switches/fire alarm stations. Restrooms, drinking fountains, and public telephones will be modified. Special signage, visual alarms, and audio alarms will be installed.

3. Upgrade Fire Protection System in Logistics Warehouse Area 600,000

This project will upgrade the fire alarm and fire fighting features of the KSC Logistics Warehouse and Petroleum/Oil/Lubricant (POL) storage area, bringing them into compliance with applicable fire codes. Sprinkler heads will be added, extended, replaced, and relocated; fire pump controls and monitoring systems will be upgraded; fire alarm panels will be rearranged for improved access; and various hazardous material enclosures will be upgraded to a higher fire rating.

4. Rehabilitate Hypergol Maintenance Facility Firex Pump Station 710,000

This project rehabilitates the Hypergol Maintenance Facilities firex pump station, including replacement of the 37 year old fire pump engines and upgrade of the 20 year old control systems. Increasing potential for firex system failure and extended downtime for maintenance due to a lack of availability of spare parts is intolerable. Facilities protected by this fire system directly support Space Shuttle and Expendable Launch Vehicle payload processing and are mission critical.

5. Restore Heavy Equipment Facility Maintenance Yard *500,000*

This project will restore approximately 13,000 square meters in the vicinity of the heavy equipment storage area. Part of the area will be paved with asphaltic or portland cement concrete. The remainder of the area will be resurfaced with stabilized gravel. This project will allow percolation of storm water falling on the parking areas, eliminating direct runoff into existing wetlands, in violation of St. John's River Water Management District regulations. The new pavement eliminates problems associated with sandy materials that invade the parked heavy equipment, thus increasing maintenance and shortening component life.

6. Replace Lighting in Launch Control Center Firing Rooms 1-4 450,000

This project replaces approximately 850 lighting fixtures in the KSC Launch Control Center Firing Rooms 1-4 with an improved state-of-the-art system. The improved lighting system will enhance reliability of illumination in these launch-critical areas and lower maintenance costs. The new system will also provide significant energy efficiency which is part of a center-wide effort to comply with the executive order to reduce power consumption 20% by the year 2000.

G. Langley Research Center (LaRC) $3,360,000

1. Modifications to the 60-Foot Space Simulator (1295) 820,000

This project provides for the installation of a new steam ejector system at the 60-Foot Space Simulator facility. The new steam ejector system will include all controls, pumps, valves, and

instrumentation, as well as connection to the existing cooling tower water system, steam and condensate systems, and the vacuum system which currently serves the facility. The present system requires approximately 3 hours to evacuate the three spheres from 33,350 Pa to 1,330 Pa. This project will reduce the pump down time for these three vacuum spheres by a factor of six, thereby significantly increasing the productivity of the two hypersonic wind tunnels it serves.

2. Modifications to Upgrade Forced Oscillation Test Rig (1212C) 680,000

This project provides for upgrades of the forced oscillation model test rig in the 14- by 22-Foot Tunnel. The new rig will be capable of handling models up to 90 kilograms with motion accuracy of plus or minus 0.17 degrees over an oscillation amplitude ranging from 0 to plus or minus 30 degrees. The existing 20 year old rig is badly worn and excessive motion between components is adversely affecting data accuracy. The new forced oscillation rig will provide increased data accuracy and reliability, as well as increased productivity due to reduced setup time.

3. Modifications to the 15-Inch Mach 6 High Temperature Tunnel (1251A) 400,000

This project provides modifications to the 15-Inch Mach 6 High Temperature Tunnel located in Building 1251A. The modifications include a new flow collector downstream of the nozzle exit, a variable area diffuser and associated controls, a new after-cooler, and associated modifications to the vacuum piping connecting the test section to the vacuum sphere. The subject diffuser is needed to provide the capability to test larger models. Productivity and efficiency of this heavily utilized facility will be enhanced by implementation of these modifications.

4. Modifications to Building 1221C for the Combustion Diagnostics Laboratory 750,000

This project provides for modifications to Building 1221C to create a new Combustion Diagnostics Laboratory. The modifications will include construction of the new 125 square meter laboratory within Room 123 of Building 1221C and installation of all utilities necessary for the laboratory. The utilities will include combustion air, fuel, oxygen, exhaust system, instrumentation and controls, electrical power, air conditioning, and cooling water. The Combustion Diagnostic Laboratory will provide "breadboarding" space for development of techniques for nonintrusive combustion diagnostics. The laboratory will provide steady state flame sources and/or supersonic reacting flow for definition of the operating characteristics of various nonintrusive combustion diagnostic devices.

5. Rehabilitation of Instrumentation and Calibration Labs, Shop, and HVAC System at Building 648 . . . . . **440,000**

This project provides for rehabilitation of the instrumentation and calibration labs and shop at Building 648, which houses the Transonic Dynamics Tunnel, to provide space for wind-tunnel and model instrumentation development, model static testing and calibration, and model preparation and assembly. The rehabilitation will include enclosing an existing area to provide an instrumentation lab, refurbishing the model calibration lab and shop, and upgrading the HVAC through the northeast portion of the building. The project will include replacement of floor tiles, wall treatment, ceiling, and lights; modifications to entrances and walls; removal of an obsolete air lock; and upgrade of electrical panel boards. The rehabilitation project will enhance the support activities for the tunnel and provide improved efficiency and productivity.

6. Rehabilitation of Fabrication Shop (1232A) **270,000**

This project provides for modifications to and rehabilitation of the 50 year old Fabrication Shop in Building 1232A. The modifications include constructing a sound barrier wall between the shop area and the technicians' work bench area, installing a masonry wall where roll-up doors currently exist in Rooms 129 and 130 and installing new air conditioning system(s) for those rooms, and installing circulation fans in the high bay area. The rehabilitation of the building includes reworking the first floor restroom to include a restroom for women and replacing the overhead steam coil heating units in the shop area. This project will bring conditions into compliance with current standards and provide a safe and efficient facility.

H. Lewis Research Center (LeRC) **$3,260,000**

1. Rehabilitation of Mechanical Systems, Development Engineering Building (500) **900,000**

This project provides for the rehabilitation of the mechanical systems in the Development Engineering Building (DEB) (500). This work includes replacement of two existing 260 ton, R-12 refrigerant chillers with two new 1,230 kilowatt chillers that will operate with an environmentally safe refrigerant. This project will also replace fan coil units, chilled water lines, and remove related asbestos insulation. The existing 30-year-old chillers are undersized and inefficient for air handling needs of the air conditioning system.

2. Rehabilitation of 10X10 Wind Tunnel Office Building (86) **860,000**

This project provides for rehabilitation of the 10X10 Supersonic Wind Tunnel Office and Control Building. The work includes rehabilitation of the building electrical power, office lighting and ceiling systems, and compliance with life safety requirements. The building is underpowered and

the electrical system contains a number of code violations. This project will upgrade the electrical system to comply with present codes and provide sufficient power and efficient lighting for this facility.

3. Modifications of Chilled Water Plant (94) *900,000*

This project will provide modifications to the Chilled Water Plant at Building 94. The work includes replacement of the two existing inoperable 180 ton chillers and associated pumps, piping, and electrical services with a new 4,220 kilowatt chiller. Presently, the connected cooling loads exceed the chiller capacity available in Building 94. The new chiller will increase the plant efficiency and capacity to meet the current institutional and research loads.

4. Rehabilitation of Mechanical and Electrical Systems, Energy Conversion Laboratory (302) 600,000

This project provides for the rehabilitation of the mechanical and electrical systems in the Energy Conversion Laboratory (ECL) (302). This work includes installation of two heating hot water boilers and controls, four air handler units, coils and piping ductwork, and controls for first and second floor labs. This project will also replace approximately 25-30 lab exhaust fans and provide an electrical system upgrade to support new boilers, air handlers, and exhaust fans. The existing air handlers in the **ECL** (302) are 30 years old and in constant need of maintenance. The new electrical and mechanical systems will provide efficient, reliable, and economical operations for the **ECL.**

I. ~~Marshall Space Flight Center (MSFC)~~ $3,580,000

1. Rehabilitate Exterior of Office and Testing Facility (4732) 900,000

This project provides for the rehabilitation of the exterior of Building 4732. Work includes providing thermal protection to exterior walls by installing insulation, face brick, and insulated glass windows. Also included is the installation of a sloped standing-seam metal roof system over the existing flat roof, the modification of the building entrances and parking, and improvements to the storm drainage system. Building 4732 is 51 years old, poorly insulated, and has severe moisture penetration problems. The proposed rehabilitation will preserve the integrity of the facility, provide an energy efficient and low maintenance building envelope, and upgrade handicapped accessibility to current standards.

2. Rehabilitate Laboratory Building (4623) 900,000

This project provides for the rehabilitation of Building 4623. Exterior work includes the installation of insulation, face brick, insulated glass windows, and a new sloped standing-seam metal roof system. Parking will be upgraded to asphaltic concrete and surrounding areas will be graded to improve drainage. Interior work includes the replacement of the heating, ventilation, and air conditioning system; the restoration of the electrical distribution system; and the renovation and reconfiguration of the interior walls, ceilings, restrooms, interior lighting, and emergency exit signs. Building 4623 is a 700 square meter laboratory facility. It is 34 years old and maintenance intensive. The proposed rehabilitation will preserve the integrity of the facility, provide an energy efficient and low maintenance building envelope, upgrade the facility to current Life Safety and Handicapped Accessibility standards, reduce operations and maintenance costs, and greatly improve the functionality of the facility.

3. Modifications to Electrical Power System (4755) 610,000

This project provides for modifications to the electrical power system in the Multi-Purpose High Bay Facility. Work to be performed includes the installation of a new 4,160/480 V transformer, a 1,000 kVA emergency power generator with associated switch gear, power panels, and a 90 square meter enclosure. The project also provides for the modification and upgrade of the existing electrical switch gear and power panels. The proposed upgrades are required to support the Environmental Control and Life Support System testing being conducted in support of the Space Station program.

4. Upgrade of Utility Control System Data Channel and Control Capability 900,000

This project provides for modifications to the MSFC Utility Control System (UCS) to upgrade and modernize its data channel and control capability. Work includes addition of computer capability to the individual building-field interface device terminals, and expanding the existing system from 10,000 to 100,000 data and control points. Data processing hardware and software will be upgrade as required. The UCS controls most of the heating, ventilation, and air conditioning systems, as well as critical alarm functions at MSFC. Despite the shortcomings of the existing UCS, it is heavily utilized for energy management and plant maintenance. This project will improve the system's speed, capability, and reliability.

5. Modifications to North Low Bay of Productivity Enhancement Facility (4707) 270,000

This project provides for the conversion of the north low bay area of the Productivity Enhancement Facility, Building 4707, from office to laboratory space. Scope includes the installation of a heating, ventilation, and air conditioning system capable of providing make-up

air to support chemical fume hoods, and with positive air pressure and replaceable HEPA filters for control of particulate contamination. The laboratories will be equipped with stainless steel laboratory furniture, hoods, lay-up tables, potable water, sinks/drains, and special utilities, as needed. Laboratory space is required to house activities in support of environmental replacement technologies, general adhesive bonding technology, and thermal analysis and mechanical tests functions. These activities require special environmental control to achieve material characterization and processing properties.

J. Michoud Assembly Facility (MAF) $1,350,000

1. Rehabilitate Fire Water Piping System $500,000

This project provides for the rehabilitation of the fire protection piping system serving Buildings 101, 102, and 103. Scope includes replacement of approximately 1,500 meters of outer perimeter mains and system components, post indicator valves, automatic sprinkler risers, and sectional control valves. The existing fire protection system is 1940's vintage. The mains and sprinkler risers are severely corroded, leak extensively, and are below the minimum thickness required by code. Valves are faulty and do not hold or close properly.

2. Rehabilitate North Chilled Water Overhead Piping (103) $850,000

This project provides for the restoration and upgrade of approximately 1,400 meters of overhead chilled water return and supply piping in the External Tank Main Manufacturing Building. The new piping will be routed differently than the existing piping to improve accessibility and maintainability. Work to be done also includes the replacement of existing valves, or the addition of new valves, as required. The chilled water piping system was originally installed in the 1940's and is very deteriorated. Pipe wall thickness has decreased by 50 percent in some areas due to severe corrosion, and current configuration does not provide sufficient valves to adequately isolate problem areas during outages. Lack of easy access to piping makes piecemeal repairs difficult and costly.

K. Stennis Space Center (SSC) $2,400,000

1. Modification of Central Heat Plant Facility (B3204) 900,000

This project provides for modification of the Central Heat Plant (B3204) to provide for the relocation of the center Fire Department and emergency response services. The work includes removal of three abandoned hot water generators and associated piping, tanks, pumps, and chemical feed stations. The existing 650 square meters will be modified to accommodate fire department apparatus; monitoring and alarm equipment; dormitory, classroom, and office space; parking bays

for pumpers and emergency response vehicles; and host drying apparatus. Work also includes asphalt paving for training drills and adequate parking for facility personnel. The project places critical fire protection services in close proximity to the key operations the fire department is required to support.

. 2. Rehabilitate Administration and Engineering Building (B1100) 900,000

This project provides for rehabilitation of the air handler units in the Administration and Engineering Building. Work includes replacement of air handlers, repair of return air fans, and replacement of noise attenuators with straight duct sections and associated asbestos removal. The existing units have exceeded their useful life with components over 30 years old which have deteriorated beyond repair.

3. Modify Utility Control System, Various Locations 600,000

This project provides for modifications to the Utility Control System (UCS). The work includes replacement of the pneumatic controls and refurbishment of the air handling units for buildings 1000, 2040, and 3110. The existing UCS and HVAC systems are more than 20 years old and many parts are no longer available for the system. This project will provide for an efficient, reliable, and maintainable energy management system.

L. Wallops Flight Facility (WFF) $890,000

1. Rehabilitation of Aircraft Hangar (N-159) 390,000

This project provides for the modification of the exterior building siding and roof top structures of this aircraft hanger. The work includes the removal of existing protected metal siding and windows; the installation of new protected steel siding, secondary support steel framing, batt insulation, metal liner panel, flashing and trim, guttering, downspouts, and splashblocks. The existing metal siding on this 35 year old hangar has outlived its life expectancy. It is damaged in places and the protective coating is cracked and peeling off. The windows in the hangar area leak and serve no useful purpose. The new metal panel system will provide a strong protective covering for the hangar and upper mechanical rooms, insulation to eliminate heat loss, and a more pleasing appearance to such a sizable structure.

2. Modification of Rocket Assembly Building 2-41 500,000

This modification consists of the removal of steel, repair of the roof, and the installation of fire protection and grounding system; the installation of two 9,000 kilogram bridge cranes in the high bay area; the upgrade of overhead lighting and electrical power panels; the replacement of overhead and personnel doors; the painting of interior/exterior finishes; the rehabilitation of

the restroom; and associated work. Building 2-41 is a high bay vertical assembly building strategically located to provide support to the launch facilities on Wallops Island. The building is 25 years old and is in need of rehabilitation due to age, deterioration, and exposure to the Island environment.

M. Various Locations $2,710,000

1. Rehabilitate and Modify Feedcone for 70-Meter Antenna, Goldstone, California 710,000

This project will provide for a new Feedcone shell to house microwave equipment, transmitter, waveguide switches, and maser. A Dichroic mirror and retraction mechanism will be fabricated and tested. This project is required to expand the capability of the 70-meter antenna to provide both X-band uplink and downlink support to flight projects.

2. Modify Power Distribution System, Goldstone, California 600,000

The project will convert the existing 2400 V radial distribution system to a loop system. The loop system will be fed from two existing 2400 V breakers so that if one of the breakers fails or is out for maintenance, the other breaker is capable of serving the connected load without any interruption. The project includes the installation of additional 2400 V cables, ducts and trenches to complete the loop system, a new substation at DSS-15 antenna, and the modification of the power plant programmable controller to adapt it to the new configuration. This will improve maintainability, redundancy, and will allow isolation and testing of the 20 year old system.

3. Modify 34-Meter Antenna (DSS-28), Goldstone, California 500,000

This project will implement site and structural changes to the antenna facility which include fencing around the antenna apron, seismic bracing for electronic equipment, and cable trays. Also, electrical modifications will be made to the pedestal, a fire detection and a safety surveillance system will be installed, and a prefabricated metal building for a motor generator set will be constructed. Redundant air conditioning will be installed at DSS-27 and DSS-28. Operational requirements for DSS-28 require these modifications to meet safety requirements and back-up cooling capacity for critical electronic equipment.

4. Modification to Launch Area #4, Poker Flats Research Range 900,000

This project provides for the modification to Launch Area #4 located at Poker Flats, Alaska. It includes sitework; elevation of rails on a concrete base; installation of a insulated mobile shelter with rollup doors; a 16.2 square meters terminal building; and the installation of power and lighting. The purpose of the modification is to provide safety and protection for personnel

and flight components from severe weather conditions during the final staging and checkout of sounding rockets on the launcher.

N. Miscellaneous Projects Not in Excess of $250,000 . . . . . **$480,000**

Total $35,000,000

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED:

Approximately $40-50 million per year will be required for continuing rehabilitation and modification needs.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

SUMMARY

MINOR CONSTRUCTION

Summary of Project Amounts by Location:	Amount	Page No.
Goddard Space Flight Center	665,000	CF 3.4-3
Jet Propulsion Laboratory	500,000	CF 3.4-3
Johnson Space Center	655,000	CF 3.4-3
Langley Research Center	665,000	CF 3.4-4
Lewis Research Center	655,000	CF 3.4-4
Marshall Space Flight Center	660,000	CF 3.4-4
Total	$3,800,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Minor Construction of New Facilities and Additions to Existing Facilities, Not in Excess of $1,500,000 Per Project

INSTALLATION: Various Locations

FY 1996 Estimate: $3,800,000

FY 1994: $14,000,000 FY 1995: $2,000,000

COGNIZANT INSTALLATIONS/LOCATIONS OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management Systems and Facilities

SUMMARY PURPOSE AND SCOPE:

These resources will provide for minor facility construction at NASA field Installations and Government-owned industrial plants supporting NASA activities. Each project in this program is estimated to cost no more than $1.5 million and involves either the construction of new facilities or additions to existing facilities. The FY 1996 request of $3.8 million will improve the usefulness of NASA's physical plant by changing the utilization of or augmenting the capabilities of various facilities. Included in this request are those programmatic and institutional projects that are essential to the accomplishment of mission objectives.

PROJECT JUSTIFICATION

The configuration of NASA's physical plant necessarily must respond to changes in utilization and adaptions required by changes in technology or in mission needs. Demands are generated by research, development, testing, and similar activities. Specific justification for each minor construction project is provided under "PROJECT COST ESTIMATE."

PROJECT:

Included in the FY **1996** minor construction program are those facility projects for institutional or technical facility needs that could be fully identified at the time of submission of this budget estimate. Items of work totaling **$3.8** million are included in this resource request and have been distilled from a list totalling over **$20** million. Projects were selected on the basis of the relative urgency of each item and the expected return on the investment. During the course of the year, the revision of priorities may require changes in some of the items to be accomplished. Such changes will be accommodated within the total resources allocated.

These projects represent requirements that must be met in this time frame to support institutional needs and programmatic objectives. The following listing summarizes the cost distribution by category of work:

a. General Purpose Buildings **2,475,000**

b. Technical Buildings/Structures **1,325,000**

PROJECT COST ESTIMATE:

A. Goddard Space Flight Center (GFSC) $665,000

1. Construct Isotope Magnet Experiment Integration Facility (ISOMAX) 665,000

This project provides for the construction of two adjacent structures that are required for integration and operation of the "ISOMAX" experiment. One is a high bay facility, 6 meters high by 93 square meters, made of non-magnetic materials. The other is a 93 square meter laboratory building. The project also includes necessary site work; utilities; access roads and parking facilities; and all associated mechanical, electrical and fire protection systems. Because of the size of the ISOMAX equipment, the use of existing integration facilities is not feasible and additional space is required.

B. Jet Propulsion Laboratory (JPL) $500,000

1. Construct Remote Sensing Instruments Laboratory, Table Mountain Observatory 500,000

The project will construct a new 250 square meter facility to house five instrument laboratories. The building will be concrete block with metal stud interior partitions and gypsum board walls and ceilings. A concrete deck, accessible via sliding glass doors, will be provided outside each lab for instrument placement and scientific observations. The building also includes minimal corridors, restrooms, utility rooms, and will be fully heated and air-conditioned. The facility will test instruments prior to their deployment to other monitoring stations throughout the world. This will support the upcoming Earth Observing System (EOS) mission, ongoing Light Detection and Ranging (LIDAR), and the Active Cavity Radiometer Iradiance Monitor (ACRIM).

C. Johnson Space Center (JSC) 655,000

1. Construct Thermal Control Systems Test Facility 655,000

This project provides for a 520 square meter preengineered metal building adjacent to the Test Article Staging Facility, Building 32Q. Approximately 360 square meters of the facility will be air-conditioned to accommodate test hardware, test consoles, computing support equipment, and rest rooms. The remainder of the building will have positive ventilation for storage of test hardware. This project is required to provide a dedicated facility for long-duration testing of Space Station Active Thermal Control Systems (ATCS) prototype and qualification hardware. Related testing currently is being conducted in a temporary enclosure in the high bay of Building 32. However, the larger sized ATCS test and support hardware being delivered in 1995 for 15 to 20 years of testing will require a larger area.

D. Langley Research Center (LaRC) $665,000

1. Construction of Addition to Nondestructive Evaluation Laboratory (1230B) 665,000

This project provides for construction of an approximately 450 square meter addition to building 1230B to provide three new nondestructive laboratories. The first laboratory will be a shearography laboratory which will include acoustic wall treatment, an acoustic test chamber, and a low pressure test chamber. The second laboratory will be a magnetics laboratory which will maintain a superconducting magnet. The third laboratory, a radiation laboratory, will be constructed as a basement and will require shielding. The existing Nondestructive Evaluation (NDE) Laboratory has been designated as the lead research laboratory for NDE in the Agency. Without the addition, the lab will have to rotate setup and breakdown of major measurement systems causing severe delays in the research/applications and loss of productivity in packing and unpacking hardware.

E. Lewis Research Center (LeRC) $655,000

1. Construction of Aero Acoustic Propulsion Lab Control Room (145) 655,000

This project provides for construction of an approximately 280 square meter single story building for the Aero Acoustic Propulsion Lab Control Room. The space will include a control room, work area, communications room, lobby, and office. The control room is required to service the expanded needs resulting from activities of the Nozzle Acoustics Test Rig. The existing control room is located in an area that is occupied by the main drive shaft for the 10x10 Supersonic Wind Tunnel, causing excessive noise and vibration. The new control room will provide a safe, clean, and environmentally controlled facility.

F. Marshall Space Flight Center (MSFC) $660,000

1. Construct Addition for Advanced Optical Fabrication Laboratory (4487-B) 660,000

This project provides for the construction of an approximately 300 square meter addition to the Straylight Facility, which is attached to the B-wing of Building 4487. The area will be designed for class 100K operations and finished with low particulate-generating and low out-gassing materials. Individual rooms will be designed to operate as class 10K laboratories, with thermal and acoustic isolation enclosures. Seismically isolated slabs will be provided. The project includes necessary support equipment and utilities such as missile grade air; central vacuum; electrical power; and heating, ventilation, and air conditioning equipment. Incidental

modifications to the existing facilities are required to accommodate the addition. A covered loading dock and an elevator will also be added. The development of an Advanced Optical Fabrication Laboratory is critical for optical research and testing. New research and technology have shown that new optical fabrication techniques, which are required for future NASA missions, require a controlled environment with low contamination and vibration isolation.

Total $3,800,000

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED: Approximately $6 million per year will be required for continuing minor construction needs.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

SUMMARY

FACILITY PLANNING AND DESIGN

		Page No.
Master Planning	$ 400,000	CF 3.5-2
Sustaining Engineering Support	700,000	CF 3.5-2
Preliminary Engineering Reports and Related Special Engineering Support	1,600,000	CF 3 5-3
Final Design	7,300,000	CF 3 5-4
Total	$10,000,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Facility Planning and Design

FY 1996 Estimate: $10,000,000

FY 1994: $21,500,000 FY 1995: **$10,000,000**

The funds requested in this estimate are required to provide for the following advance planning and design activities related to facilities activities and projects where not otherwise provided for:

a. The accomplishment of necessary studies, development and master planning for field installation and the provision of continuing engineering support and special engineering management and other services.

b. The preparation of preliminary engineering reports, cost estimates, and design and construction schedules. Also includes the preliminary engineering efforts required to initiate design-build projects.

c. The preparation of final designs which include construction plans, specifications, and associated cost estimates and schedules required to implement construction projects.

d. The accomplishment of facilities siting and other investigations, studies and reports.

A. **Master Planning** **$400,000**

Provides for updating, developing and automating existing field installation master plans. This effort includes facility studies, site investigations, and analyses of utility systems. The existing utility and civil drawings will be converted into a highly detailed electronic database using a computer-aided-design (CADD) system. Topographical features from original drawings will be merged electronically to create individual area maps or an entire center map. The master plan documents will be updated to reflect as-built conditions and to graphically represent the 5-year facility plan baseline for future development.

The NASA field center master plans are periodically updated. The master plans are essential as reference documents for land use planning, identification of physical relationships of facilities, and proper orientation and arrangement of facilities. The updates reflect as-built condition of facilities and utility systems with emphasis on changes caused by recent facility construction and modifications.

B. **Sustaining Engineering Support** **$700,000**

Provisions for facility studies and specific engineering support continue in importance as evidenced in recent years. These efforts are important due to changing cost trends in construction materials and fuels; the operation and maintenance costs for the physical plant; and energy conservation and efficiency.

The following items are included in the FY 1996 requirements:

1. Building Research Board

Covers annual support to the Federal Construction Council's (FCC) operations and provides for special studies that the Council will perform throughout FY 1996 to help advance the science and technology of Federal Government building and construction. The FCC is subordinate to the Building Research Board, National Academy of Sciences, and its activities are supported by NASA and other Federal agencies with similar construction programs.

2. Value Engineering, Cost Validations and Analyses

Provides for engineering services to improve cost-effectiveness of facility projects by subjecting project design criteria, specifications and working drawings for specific material components and systems to detailed independent reviews by engineering specialists. Also provides services necessary to predict and validate facility costs to aid in resources planning.

3. Facilities Utilization Analyses

Provides for the analyses of agencywide facilities utilization data covering (1) office and other types of building space; (2) designate major technical facilities; and (3) special studies comparing the utilization of technical facilities which are similar in type or capability, such as wind tunnels. Such analyses provide for (1) insights into and development of better methods of identifying underutilized facilities; (2) improved techniques to quantify level of facilities use; and (3) actions to improve facilities utilization. Work provides for review of each installation's inventory data base in support of the facilities utilization program. Surveys are necessary to validate the reported data in relation to a specific problem or need, and to assist in providing a credible foundation for plans to improve the use of facilities.

4. Facilities Management Systems

Provides for continued engineering support for the technical updating of NASA's master text construction specifications to reflect the use of new materials, state-of-the-art construction techniques and current references to building codes and safety standards.

5. Independent Analysis and Third Party Reviews

Provides the technical and engineering support analyses, designs, and reviews required to verify, confirm and ensure suitability of construction designs within the project cost estimates.

6. Facilities Engineering Metrication

Required to support the transitioning of NASA facilities engineering designs and specifications from the English inch-pound system to metric, as required by Presidential Executive Order 12770 of July 25, 1991.

C. Preliminary Engineering Reports and Related Special Engineering Support $1,600,000

1. Preliminary Engineering Reports (PERs) . . . . . (1,300,000)

This estimate provides for preparation of PERs, investigations, and project studies related to proposed facility projects in the FY 1998 and FY 1999 Construction of Facilities programs. These reports are required to permit the early and timely development of the most suitable project to meet the stated programmatic and functional needs. Reports provide basic data, cost estimates and schedules relating to future budgetary proposals. This request provides for PERs associated with proposed construction. The estimated cost of PER support for FY 1998 construction projects is $1,000,000, which will permit updating of PERs for $20 to $30 million in construction, and the

development of new **PERs** for an additional $45 to $55 million in projects. *An* additional $300,000 has been included in this line for the completion of new **PERs** for approximately $15 to $20 million of construction projects which will be high priority candidates for inclusion in the FY 1999 Construction of Facilities program. The activity associated with FY 1999 will be confined to the highest priority candidates.

2. Related Special Engineering Support . . . . . ***(300,000)***

This estimate provides for investigations and project studies related to proposed facility projects to be included in the subsequent Construction of Facilities programs. Such studies involve documentation and validation of "as-built" conditions, survey/study of present condition of such items as roofing and cooling towers, utility plant condition and operational modes, and other like studies. These studies are required to allow for the timely development of projects to meet the stated functional needs and to provide basic data, cost estimates and schedules for related future budgetary proposals.

D. Final Design **$7,300,000**

The amount requested will provide for the preparation of designs, plans, drawings, and specifications necessary for the accomplishment of projects. Projects involved are planned for inclusion in the FY 1997 and FY 1998 programs. The goal is to obtain better facilities on line earlier at a lower cost. The request will provide for final design work associated with construction proposed for the FY 1997 program, estimated to cost $90 to $100 million, and for $10 to $20 million of high potential projects proposed for the FY 1998 program. The final design amount included for FY 1997 candidates and for residual requirements of this nature which have accumulated from prior years activities is $6,100,000. For FY 1998 $1,200,000 is included and design activity will be confined to the highest priority candidates.

Total $10,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

SUMMARY

ENVIRONMENTAL COMPLIANCE AND RESTORATION

Summary of Project Amounts by Location:	Amount	Page No.
Ames Research Center	$4.300.000	CF 3.6-3
Dryden Flight Research Center	1.100.000	CF 3.6-4
Goddard Space Flight Center	400.000	CF 3.6-4
Jet Propulsion Laboratory	2.400.000	CF 3.6-4
Johnson Space Center	400.000	CF 3.6-5
Kennedy Space Center	5.950.000	CF 3.6-5
Lewis Research Center	2.800.000	CF 3.6-6
Marshall Space Flight Center	3.900.000	CF 3.6-7
Michoud Assembly Facility	2.000.000	CF 3.6-8
Stennis Space Center	3.150.000	CF 3.6-8
Wallops Flight Facility	1.000.000	CF 3.6-8
White Sands Test Facility	1.000.000	CF 3.6-9
Miscellaneous Projects Not in Excess of $250.000 Each	970.000	CF 3.6-9
Remedial Investigations. Feasibility Studies. Assessments. Studies. Design. and Related Engineering	7.630.000	CF 3.6-9
Total	$37,000,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1996 ESTIMATES

PROJECT TITLE: Environmental Compliance and Restoration Program

INSTALLATION: Various Locations

FY 1996 Estimate: $37,000,000

FY 1994: $50,000,000 FY 1995: $35,000,000

COGNIZANT INSTALLATIONS/LOCATIONS OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management Systems and Facilities

SUMMARY PURPOSE AND SCOPE:

These resources will provide for studies, assessments, remedial investigations, feasibility studies, design, related engineering, and remedial action projects for environmental compliance and restoration measures at NASA field installations, Government-owned industrial plants supporting NASA activities, and other locations where NASA operations have contributed to environmental problems and NASA is obligated to contribute to cleanup costs. In addition, these resources will be used to provide for regulatory agency oversight costs and to acquire land if necessary to implement environmental compliance and restoration measures. The purpose of this program is to enable NASA to comply with mandatory environmental statutory requirements and standards, cleanup orders and regulatory agreements. The resources authorized and appropriated pursuant to this program may not be applied to other activities. The program includes studies or assessments to determine compliance status and options for remedial action; conduct of prescribed remedial investigations and feasibility studies as required by Federal environmental laws; and

performance of environmental restoration, hazardous waste removal and disposal, cleanups, and closures.

PROJECT JUSTIFICATION/DESCRIPTION:

Proposed environmental compliance and restoration projects and activities for Fiscal Year 1996 tbtal $37 million, which has been distilled from requests of approximately $73 million. This program represents only a modest request in relation to the total requirements for environmental compliance and restoration that must be implemented within the next several years. Based on relative urgency and potential health hazards, the following listed projects are the highest priority requirements currently planned for accomplishment in FY 1996. Deferral of these necessary remedial measures would preclude NASA from complying with environmental requirements and jeopardize critical NASA operations. The remedial investigations, feasibility studies, assessments, design, and related engineering costs are estimated to be approximately $7,630,000. Projects estimated to cost less than $250,000 have not been described or identified by specific location. The estimated cost of these projects is $970,000. As studies, assessments, remedial investigations, feasibility studies, and designs progress and as new discoveries or regulatory requirements change, it is expected that priorities may change and revisions of the activities and projects may be necessary.

The following listing summarizes broad categories of effort to be undertaken with projects of an estimated cost of over $250,000:

a.	Hazardous Waste Corrective Actions/Cleanups	$22,250,000
b.	Hazardous Waste and Material Storage and Control	1,700,000
c.	Air Pollution Control	2,950,000
d.	Water Pollution Control	1,500,000

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC) $4,300,000

1. Remediation of Contaminated Soil and Groundwater, National Full-scale Aerodynamics Complex (NFAC) 1,200,000

This project provides for the remediation of soil and groundwater contamination around the NFAC area. The project provides follow-on actions as required for the cleanup of petroleum hydrocarbons and solvent contamination found in soil and/or groundwater from previous and ongoing site investigations. The proposed remedial work includes removal, disposal, and/or in situ treatment of contaminated soil and groundwater based on recommended remedial actions. It also includes all associated work necessary for site cleanup including sampling, analyses, and well installation. The project is required to comply with the federal Resource Conservation and Recovery Act (RCRA), state, and local regulations.

2. Remediation of Groundwater Contamination, Middlefield-Ellis-Whisman (MEW) Superfund Site 350,000

This project will continue to provide for NASA's contribution to the remediation of groundwater contamination from the MEW Superfund Site. Ames has been designated a potentially responsible party (PRP) by the Environmental Protection Agency (EPA) for the MEW site contamination. The project provides a portion of the funds needed to comply with requirements under the Record of Decision (ROD) for treatment and cleanup of contaminated soil and groundwater, including reuse of extracted groundwater to the maximum extent possible. The ROD was issued under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) with the EPA and by state and local regulators.

3. Wastewater Pretreatment Facilities 1,500,000

This project will construct wastewater pretreatment and associated collection facilities for the preliminary treatment of industrial wastewater discharged from certain Ames facilities. Wastewater generated from Ames discharges into the Publicly Owned Treatment Works (POTWs) systems of the cities of Sunnyvale and Palo Alto. The cities are lowering the contaminant levels for discharges entering into their wastewater treatment systems. This project will provide pretreatment facilities necessary to reduce contaminant levels from wastewater generated at Ames and discharging into the POTWs in order to comply with existing and proposed local ordinances.

4. Retrofit Thermal Protection Laboratory Boiler (N234A) for Air Emissions 1,250,000

This project will provide for the retrofit/replacement of an existing boiler to meet air emission standards. Results of required source emissions testing on the boiler indicated exceedances on the nitrogen oxides (NOx) emissions levels and a wide variation in the carbon monoxide (CO) emission levels from required regulatory standards. The boiler will be retrofitted/replaced to meet regulations of the Bay Area Air Quality Management District (BAAQMD). Possible retrofits include new burners and NOx controls. The BAAQMD is currently a nonattainment area for carbon monoxide and ozone. NOx emissions contribute to ozone depletion.

B. Dryden Flight Research Center (DFRC) $1,100,000

1. Soil and Groundwater Contamination Assessment 1,100,000

This project provides for continuation of site assessments and investigations required at DFRC. The Center is a tenant of the Edwards Air Force Base (EAFB) and is identified as Operable Unit No. 6 under the EAFB Superfund site. This project will provide for continuation of the site investigations, characterization and site assessments that include soil borings, sampling and analyses, well installation, and similar activities. The project may provide for interim remedial action activities as necessary during investigations to remove site contamination. This project is required as part of the CERCLA process.

C. Goddard Space Flight Center (GSFC) $400,000

1. Remediation and Cleanup of Landfills 400,000

This project provides for the remediation and clean up of GSFC's closed landfills identified during the investigation, characterization, and assessment period. Preliminary assessment of the area has indicated some soil and groundwater contamination. The project includes well installation, sampling, analyses, soil borings, and disposal. This project is required to bring GSFC into compliance with CERCLA/RCRA and state of Maryland regulations.

D. Jet Propulsion Laboratory (JPL) $2,400,000

1. Cleanup of Arroyo Seco Groundwater Contamination 2,000,000

This project ensures continuation of the groundwater cleanup effort of the Arroyo Seco aquifer contamination. Sampling and testing of groundwater in the vicinity of JPL confirmed the presence of contaminants beneath the site and in nearby production wells, in excess of Federal and State of California standards. This portion of the project provides for continuation of remedial

investigations and feasibility studies, remedial design, and payment of state oversight costs as required by the Federal Facilities Agreement (FFA). The site is listed in the EPA's National Priorities List and subject to the provisions of CERCLA, state, and local requirements.

2. Environmental Assessment/Cleanup, Edwards Test Facility (ETF) 400,000

This project provides for continuation of site assessments and investigations as required for closure of the ETF. The facility is a tenant of the Edwards Air Force Base (EAFB) and is identified as Operable Unit No. 5 under the EAFB Superfund site. The project will provide for continuation of the site investigations, characterization and site assessments to include soil borings, sampling and analyses, well installation, and other related activities. The project may also provide for interim remedial actions as necessary during investigations to remove site contamination. This project is required as part of the CERCLA process.

E. Johnson Space Center (JSC) $400,000

1. Install Volatile Organic Compound Controls, Ellington Field 400,000

This project provides for the installation of a system to control volatile organic compounds in the painting operations at Ellington Field. The work includes modifications to the existing ventilation system and the installation of a filtration system to bring the facility into compliance with the Clean Air Act Amendments (CAAA) and State of Texas requirements.

F. Kennedy Space Center (KSC) $5,950,004

1. Remediation of Old Bus Maintenance Area 1,100,000

This project provides for remediation of fuel contaminants to soil, surface water, and groundwater. The work follows on previous site investigations indicating fuel contaminants in the soil and groundwater around the fuel storage area caused by leaks and/or spills. Implementation of the remediation will require soil excavation, sampling and analyses, treatment and/or removal of contaminated soils, installation of groundwater wells, and treatment systems capable of removing the contamination. The project is required to comply with the federal RCRA, state and local regulatory requirements, and property lease agreements.

2. Remediation of Payload Hazardous Servicing Facility Fuel Spill 1,150,000

This project provides for remediation of fuel contaminants to soil, surface water and groundwater. The work follows on previous site investigations indicating fuel contaminants caused by a spill around the servicing facility. Implementation of the remediation will require

soil excavation, sampling and analyses, treatment and/or removal of contaminated soil, installation of groundwater wells, and treatment systems capable of removing the contamination. The project is required to comply with the federal RCRA, state, and local regulatory requirements.

3. Close Ransom Road Landfill 1,700,000

This project provides for the closure of the landfill and includes additional facility assessments and investigations to determine and evaluate contamination caused by the landfill use. The work follows on previous site investigations and recommendations resulting from regulatory review. Proper closure of the landfill requires construction of a multilayer cap of soil and an impermeable synthetic membrane over 10 acres of the landfill, including a gas collection system and seed and mulch over the cap surface. The project is required to comply with the federal RCRA and State of Florida regulatory requirements.

4. Remediation of Launch Complex 39 Fuel Spill 900,000

This project provides for remediation of fuel contaminants to soii, surface water and groundwater. The work follows on previous site investigations indicating fuel contaminants caused by an oil spill at the site. Implementation of the remediation will require soil excavation, sampling and analyses, treatment and/or removal of contaminated soil, installation of groundwater wells, and treatment systems capable of removing the contamination. The project is required to comply with the federal RCRA, state, and local regulatory requirements.

5. Remediation of Spaceport U.S.A. Diesel Fuel Storage Area 1,100,000

This project provides for remediation of fuel contaminants to soil, surface water and groundwater. The work follows on previous site investigations indicating fuel contaminants around the diesel fuel storage areas of Spaceport U.S.A. Implementation of the remediation will require soil excavation, sampling and analyses, treatment and/or removal of contaminated soil, installation of groundwater wells, and treatment systems capable of removing the contamination. The project is required to comply with the federal RCRA, state, and local regulatory requirements.

G. Lewis Research Center (LeRC) $2,800,000

1. Remedial Investigation/Feasibility Study (RI/FS) 2,000,000

Group 2 Project Management Units

This project provides for continuation of the effort to investigate and remediate site contamination at project management units within the Lewis Research Center. This portion of the work will continue the Remedial Investigation/Feasibility Study (RI/FS) work to further evaluate and assess contamination at identified areas. The work includes sampling and analyses for site characterization, feasibility studies, treatability studies, evaluation, and selection of remedial alternatives to further identify and evaluate treatment options. The work follows the

CERCLA process and incorporates state requirements. Findings and orders have been issued to Lewis by the State of Ohio Environmental Protection Agency (OEPA).

2. Air Pollution Controls 800,000

This project provides for the installation of air pollution controls at the Lewis Research Center. Project requirements follow air emission assessments and include modification of existing systems and installation of equipment to control emissions of air contaminants including carbon monoxide, nitrogen oxide, and volatile organic compounds. The Cleveland area is a nonattainment area for carbon monoxide and ozone. This project implements requirements under the CAAA and state regulations.

H. Marshall Space Flight Center (MSFC) $3,900,000

1. Resource Conservation and Recovery Act Facility Investigation (RFI) 2,000,000

This project is a continuation of the work required for assessment, investigation, and cleanup of sites with potential contamination as identified in the Preliminary Assessment (PA) by the Environmental Protection Agency (EPA) and MSFG. This project will finalize the investigations and begin the initial phase of the Resource Conservation and Recovery Act (RCRA) Corrective Measures Study for the sites and areas of concern determined to require remediation.

2. Cleanup of Groundwater Contamination, Santa Susana Field Laboratory (SSFL) 1,000,000

This project is a continuation of the assessment, characterization, and cleanup of the groundwater, including assessment of the hydrogeological regime currently underway at SSFL. The assessment work will consist of well installations, sampling, and analyses. The project also includes removal actions during the investigative work. Current results indicate a high level of trichloroethylene in the groundwater, which has been associated with rocket engine testing performed at SSFL by both NASA and the Air Force. This project is required for compliance with the Resource Conservation and Recovery Act (RCRA) and State of California regulations.

3. Resource Conservation and Recovery Act Investigation and Cleanup, SSFL 900,000

This project will provide for the cleanup of the sites identified in the investigation, characterization, and assessment period for the RCRA identified units at SSFL. The sites were identified by the Environmental Protection Agency (EPA) and the State of California. The sites involved in this investigation include NASA's Area II and sites associated with rocket engine testing on Rocketdyne's Areas I and 111. This project will include the initiation of the cleanup and involve a wide array of activities including soil borings, well installations, sampling and analyses, and soil removal.

I. Michoud Assembly Facility (MAF) $2,000,000

1. Remediation Activities, MAF 2,000,000

This project is a continuation of the investigation and remediation activities associated with the Solid Waste Management Units (SWMUs) identified during the Resource Conservation and Recovery Adt (RCRA) facility investigation. The work may include removal actions, interim corrective measures, soil disposal, well drilling, soil borings, sampling, and bench scale testing of remedial alternatives. The work follows on activities identified in the Corrective Measures Study. This project is required by MAF's RCRA permit.

J. Stennis Space Center (SSC) $3,150,000

1. Install Emission Scrubbing Systems 500,000

This project provides for the construction and installation of emission scrubbing and monitoring systems at SSC. The work includes modifications to the existing ventilation systems and installation of scrubbing, control, and monitoring devices to bring the facility into compliance with CAAA and State of Mississippi requirements.

2. Cleanup of the Herbicides/Pesticides Handling Area 2,000,000

This project provides for continuation of the remediation of contaminated soil and groundwater associated with SSC herbicide/pesticide handling facility (SWMUs 7 and 10). The work includes well installation, groundwater treatment, contaminated material removal and disposal, and backfill of any excavated areas. The project is required to be in compliance with Federal and State of Mississippi regulations.

3. Remedial Investigations/Feasibility Studies (RI/FS), Various Sites 650,000

This project provides for the investigation and assessment of the remaining sites identified by the EPA in SSC's expanded site investigation. The work includes well installation, sampling, analyses, soil borings, soil removal, and disposal of contaminated or hazardous wastes. This project is required by CERCLA/RCRA and the State of Mississippi regulations.

K. Wallops Flight Facility (WFF) $1,000,000

1. Restoration and Remediation of Contaminated Sites 1,000,000

This project provides for the investigation and remediation of various sites identified during the investigation, characterization, and assessment period. Preliminary assessment of the areas

have indicated some soil and groundwater contamination. The project includes well installation, sampling, analyses, soil borings, and disposal. This project is required to bring WFF into compliance with CERCLA/RCRA and State of Virginia regulations.

L. White Sands Test Facility (WSTF) $1,000,000

1. Groundwater Contamination Assessment and Remediation 1,000,000

This project is the continuation of the ongoing groundwater assessment at WSTF. The project provides for report preparation, additional investigation and assessment, and technical support in defense of the long term solution WSTF will propose as a result of the assessment. The reports, investigations, and the final proposed solution are required by WSTF's RCRA 3008(h) consent order.

M. Miscellaneous Projects Not in Excess of $250,000 Each . . . . . $ 970,000

N Remedial Investigations, Feasibility Studies, Assessments, Studies, Design, and Related Engineering . . . . . $ 7,630,000

Total $37,000,000

FUTURE ESTIMATED CONSTRUCTION FUNDING REQUIRED:

Approximately $45-$55 million per year for the next few years is the current estimate for meeting Environmental Compliance and Restoration requirements. This figure will become better defined as studies are completed and remediation projects are reviewed by Federal, state and local regulators.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1996 ESTIMATES

INSPECTOR GENERAL

PROGRAM GOALS

The goal of the Officeof Inspector General is to serve as an independent and objective audit and investigative organization to assist NASA in achieving economy, efficiencyand effectivenessin the administration of its programs and operations, and to prevent and detect fraud and mismanagement.

STRATEGY FOR ACHIEVING GOALS

The NASA Office of the Inspector General (OIG),established by the Inspector General Act of 1978 (P.L. 95-452), seeks to work cooperatively with NASA management and program managers to carry out its various audit and investigative responsibilities. The primary responsibilities of the OIG are: (1)to provide assistance and work cooperatively with Agency management as it carries out NASA's program and operations: (2)maintain a balanced audit and inspection programs which include providing technical assistance in the audit of the Agency's financial statement as required by the Chief Financial Officers(CFO) Act: and (3) concentrate investigative resources on procurement fraud matters. including emphasis on prevention initiatives. The OIG investigators, auditors, and inspectors conduct independent reviews, studies. and analyses of NASA's programs and operations. The OIG works jointly with other Officesof Inspector General, the Federal Bureau of Investigation (FBI),the Defense Contract Audit Agency (DCAA), and other investigative and audit entities when concurrent jurisdiction exists.

The OIG has responded to the spirit of reform in government promulgated by the National Performance Review. The OIG maintains a cooperative spirit with NASA management as audits are conducted of Agency programs and operations. To the extent appropriate and permitted by law, management is apprised of significant investigative matters. The OIG continues to reexamine its procedures and processes to become more collaborative and less adversarial in dealings with NASA management, while assuring that the OIG's statutory independence is maintained. The OIG will continue to selectively concentrate staff resources on those programs and operations identified as the most critical and vulnerable to fraud and abuse based on funding levels, program needs. Congressional/Administration concerns and results of OIG research and findings.

The OIG is organized into three major units: Audits, Investigations and Administration, and Inspections. Audits are prioritized and selected to evaluate programmatic. operational and financial management concerns, problems, and vulnerabilities. The Investigations activities remain focused on complex procurement fraud matters, criminal and noncriminal, fraud against the Government by contractor and government employees, product substitution: procurement irregularities; unethical and improper conduct: and waste and management. Inspections will be conducted which support management's interests and concerns in achieving the programmatic objectives more efficientlyand effectively: issues of Congressional concern; and matters of high agency vulnerability as identified by the OIG.

MEASURES OF PERFORMANCE

	FY 1994	FY 1995	FY 1996
Office Staff Ceiling			
Full-Time Permanent	204	210	210
Investigations			
Cases pending beginning of year	416	364	351
Opened during year	367	372	383
Closed during year	419	385	362
Cases pending end of year	364	351	372
Audits			
Audits pending beginning of year	70	82	84
Opened during year.	76	64*	60+
Closed during year	64	62	58
Audits pending end of year..	82	84	86

* Instituting emphasis on programmatic audits

ACCOMPLISHMENTS AND PLANS

This request represents the resources (FTE's) needed at NASA Headquarters and the field offices to fulfill the OIG mission. Recognizing that the identifled audit., investigative. and inspections workload significantly exceeds the available resources, continuous adjustments of priorities will be necessary to ensure that balanced coverage of NASA's programs and operations is maintained, that critical and sensitive matters are promptly evaluated and investigated, and that all OIG customers receive timely, accurate and complete responses.

The OIG audit and inspection programs set priorities for internal and external audits and evaluations to maximize the return on available staff resources. These priorities are established and contained in strategic plans for each major program area - space flight. space station, space science, aeronautics, mission to planet earth, space communications, financial management, management systems and facilities. and procurement. The OIG uses a formal, comprehensive process to identify, review, prioritize and select the audits and evaluations to be performed.

The OIG audit and inspection workload and assignments are derived by: (1) working closely with management and program managers to determine programmatic concerns and vulnerabilities: (2) selecting audits using a structured internal audit universe encompassing NASA's programs and operations and an external universe comprised of NASA's prime contractors, their subcontractors and grantees: (3) addressing issues required by laws and internal regulations: and (4) responding to management's

requests for independent evaluations of programmatic concerns. The audits and inspections identifled from these sources are prioritized and compared to available resources and published in the annual OIG plan. The OIG will continue its implementation of the program manager concept to obtain greater visibility and awareness of issues related to NASA's major programs which will be included in the audit plan.

The defined audit workload far exceeds available staff which will require continuous adjustment of priorities to provide balanced coverage of programs and operations most vulnerable to abuse and mismanagement. Further, program/project change, growth, delay and termination increase the need for OIG oversight of contractor/subcontractor/grantee cost, schedule and performance effectiveness. NASA's continued reliance on contractors and grantees (about 90% of the agency's total obligations are for procurement) requires direct OIG involvement and oversight of Defense Contract Audit Agency and Health and Human Services OIG audits of NASA contractors and grantees, to ensure effective contract and grant execution and administration. NASA was billed approximately $17 million during FY 1994 for contract audit services.

The OIG plans to continue implementing its internal program manager concept to ensure visibility and awareness of significant issues related to major NASA programs/projects. During FY 1996. the OIG will focus attention and provide support to program managers on issues relating to: Space Station. Earth Observing System, Space Shuttle, Spacelab, space science projects, etc. The functional areas to be evaluated will include procurement and contract administration, technology transfer, financial management, Information Resources Management (IRM), and facilities and equipment.

The OIG will continue to monitor and assess NASA's high risk areas, material weaknesses and areas of significant concern to ensure that corrective actions are implemented timely. Areas of emphasis will include: financial systems-accounting: procurement and environmental programs: institutional contracting practices: contract management: printing management: contractor-held property: contractor cost reporting; allotment and budgetary controls: and financial reporting/general ledger. Financial management's significance increased with the passage of the Chief Financial Officers Act requiring the OIG to audit and render an opinion on the agency's annual financial statement, its internal control structure and its compliance with laws and regulations. Our financial audits will concentrate on accounting controls. information systems and required performance measurements.

Agency vulnerabilities are determined by taking into consideration the following: (1) whether program/project objectives are accomplished in the most cost effective manner: (2) whether NASA's more than $1 billion annual expenditure on information technology is providing expected programmatic and financial information needed to make sound decisions (NASA is the top ranked civilian agency in information technology spending): (3) management's actions to correct internal control weaknesses reported under the Federal Manager's Financial Integrity Act: (4) improvements in financial management systems, practices, controls and information: (5) effectiveness of the audit follow-up system in enabling management to maintain the status of corrective actions; (6) completeness of safety and mission quality activities: and (7) the adequacy of agencywide corrective actions addressing environmental concerns. These identifled vulnerabilities are then evaluated. prioritized and included in our plans for further action.

The OIG investigative workload of both criminal and noncriminal cases continues to exceed the availability of investigative resources. The massive workload of the investigative program has caused the OIG to be primarily reactive with emphasis given to the more serious criminal allegations. (Historically, criminal allegations represent about 85% of our total Investigative caseload.) The FY 1996 Investigative staffing level will enable and require OIG management to effectively manage the complex workload of both criminal and civil matters. As the number of complex procurement fraud cases continues to increase, and with such cases taking longer to resolve, our flexibility to improve and expand the program is reduced. Also, the quantity of investigative allegations received requires a preliminary evaluation to determine their potential impact and, if serious. opening an investigation, further adversely affecting the timely completion of ongoing cases. We continue to work with management by referring the more routine administrative matters to them for their resolution, keeping the OIG advised of the action taken. The investigations program managers. like audit. are assessing the allegations and cases on a programmatic basis to determine their seriousness and impact to the programs in meeting their objectives.

In summary, the OIG will collaborate with agency management to address issues of joint concern and to Improve the scope, timeliness and thoroughness of its oversight of NASA programs and operations, identify preventive measures, and enhance its capability to assist NASA management to efficiently and effectively achieve program/project goals and objectives.

INSPECTOR GENERAL

FISCAL YEAR 1996 ESTIMATES

BUDGET SUMMARY

OFFICE OF INSPECTOR GENERAL

SUMMARY OF RESOURCES REQUIREMENTS

	FY 1994	FY 1995	FY 1996
		(Thousands of Dollars)	
I. Personnel & related costs	13,840	14,500	15.700
11. Travel	531	800	800
III. Operation of installation	356	700	800
A. Technical services	(194)	(500)	(555)
B. Management & operations	(162)	(200)	(245)
To	14,727	16,000	17,300

	FY 1994	FY 1995	FY 1996
		(Full-Time Equivalents - FTE's)	
Full-time permanent	194	200	200
Other controlled full-time equivalent (FTE's)	10	10	10
To	204	210	210

BASIS OF FY 1996 FUNDING REQUIREMENT

	FY 1994	FY 1995 (Thousands of Dollars)	FY 1996
I. Personnel and related costs	13,840	14,500	15,700
A. Compensation & Benefits	13,640	14,055	15,235
1. Compensation	11,221	11,701	12,725
a Full-time permanent	10,710	11,111	12,125
b. Other than full-time permanent	245	340	340
c. Overtime & other compensation	266	250	260
2. Benefi	2,419	2,354	2,510
B. Supporting costs	200	445	465
1. Transfer of personnel	59	275	275
2. Personnel training	131	150	170
3. OPM services	10	20	20

	FY 1994	FY 1995 (Thousands of Dollars)	FY 1996
II. Travel	531	800	800

Travel funding is required to carry out audit, investigation, inspection and management duties. This funding allows for increases in per diem. airline costs. and workloads. The travel is being kept at the same level, however, increased travel by technical personnel is anticipated.

III. Operation of installation	356	700	800

Operation of installation provides a broad range of services and equipment in support of the Inspector General's activities.

A. Technical services.	194	500	555

This estimate provides for all equipment, including the lease, purchase, maintenance, programming and operations of automated data processing (ADP) equipment. NASA provides common services items such as office space, communications. supplies. and printing and reproduction at no charge to the Office of Inspector General. The funding for technical services will cover the cost of providing an electronic data processing (EDP) upgrade. equipment to employees, and replacing equipment that has become outdated or unserviceable. As funding permits, the OIG will begin implementing its strategic plan to modernize its EDP capabilities OIG wide. In FY 1996, the OIG will begin purchasing hardware and software associated with the plan to move from a mainframe environment to a personal computer (PC)-to-PC based environment.

B Management and operations	162	200	245

Included in this category are miscellaneous expenses within the Office of Inspector General, i.e., GSA cars. the Inspector General's confidential fund, miscellaneous contracts. and supplies not provided by NASA. The increase in Installation Common Services will primarily allow for audit and investigative contractor support and other specialized activities which the OIG cannot perform internally.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION LANGUAGE

OFFICE OF INSPECTOR GENERAL

For necessary expenses of the Office of the Inspector General in carrying out the provisions of the Inspector General Act of 1978, as amended, [$16,000,000] *$17,300,000. (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1995.)*

Fiscal Year 1996 Budget Estirnates